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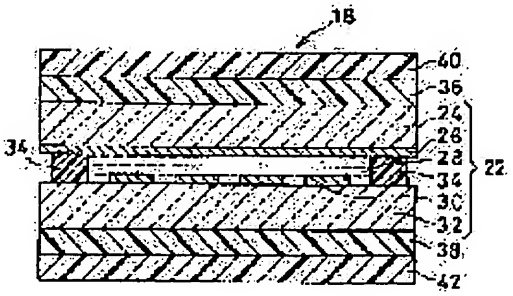
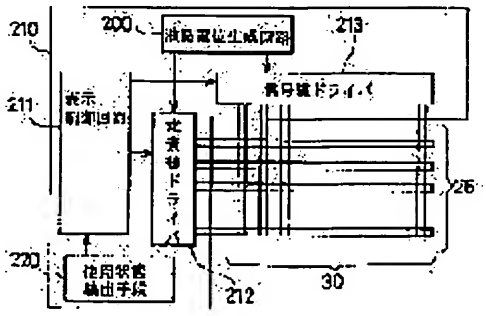
(54) ELECTROOPTICAL DEVICE AND ELECTRONIC APPLIANCE USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To attain image display over an entire area on one side of a liquid crystal panel, while in a part on the other side.

SOLUTION: A double display type liquid crystal display device 18 has a liquid crystal panel 22, with a liquid crystal layer 28 held between a pair of substrates 24, 32, a pair of reflective polarizing plates 36, 38 which are disposed on both sides of the liquid crystal panel, reflect polarized light having axis of polarization in a 1st direction, transmit the polarized light having the axis of polarization in a 2nd direction which is different from the 1st direction and form 1st and 2nd display faces, capable of displaying images on both sides of the liquid crystal panel, a service condition detecting means 220 which detects a 1st usage condition for displaying the image on the 1st display face and a 2nd usage condition for displaying the image on the 2nd display face and a drive circuit 210, which makes a region of the 1st display face the display region and makes the other region the non-display region, when the 1st usage condition is detected and makes the whole area of the 2nd display face into a display region, when the 2nd service condition is detected.





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CLAIMS

[Claim(s)]
[Claim 1] An image can be checked by looking from both-sides side of the 2nd screen which counters with the 1st screen and this 1st screen in the electro-optic device which comes to have an electro-optics layer between the substrates of a pair. And the electro-optic device characterized by having the driving means which changes the rate of the viewing area of the screen, and a non-display field according to the busy condition selectable and chosen [the 1st busy condition which checks said 1st screen by looking, and the 2nd busy condition which checks said 2nd screen by looking].
[Claim 2] The electro-optic device characterized by having a busy condition detection means to detect whether either of said 1st busy condition and said 2nd busy condition was chosen in an electro-optic device according to claim 1.
[Claim 3] The electro-optic device with which said driving means makes some fields of said 1st screen a viewing area, and is characterized by enabling a display of an image in an electro-optic device according to claim 2 only at said viewing area by making other fields of said 1st screen into a non-display field when said 1st busy condition is detected by said busy condition detection means.
[Claim 4] In the electro-optic device of a publication, two or more scanning lines are formed in either among claim 1 thru/or claim 3. ** Two or more signal lines arranged so that said two or more scanning lines may be intersected are prepared. The display-control circuit where each pixel on said 1st and 2nd screens is formed in each location where two or more of said scanning line and said two or more signal lines cross, and said driving means controls image display, The scanning-line driver which is controlled by this display-control circuit and carries out sequential supply of the scan potential at said two or more scanning lines, The electro-optic device characterized by having with the signal-line driver which supplies the signal potential corresponding to each pixel which was controlled by said display-control circuit and connected to said two or more signal lines to coincidence.
[Claim 5] It sets to an electro-optic device given in either among claim 1 thru/or claim 3. Two or more signal lines arranged so that two or more scanning lines and said two or more scanning lines may be intersected are prepared. The display-control circuit where each pixel on said 1st and 2nd screens is formed in each location where two or more of said scanning line and said two or more signal lines cross, and said driving means controls image display, The scanning-line driver which is controlled by this display-control circuit and carries out sequential supply of the scan potential at said two or more scanning lines, The electro-optic device characterized by having with the signal-line driver which supplies the signal potential corresponding to the pixel which was controlled by said display-control circuit and connected to said two or more signal lines to coincidence.
[Claim 6] The electro-optic device with which said display-control circuit is characterized by supplying the signal potential which turns OFF said screen at the signal line corresponding to said non-display field of said two or more signal lines in said signal-line driver, and supplying the signal potential according to image data only to the signal line corresponding to said viewing area in an electro-optic device according to claim 4 or 5 when said 1st busy condition is detected by said busy condition detection means.
[Claim 7] The electro-optic device characterized by for said display-control circuit choosing only the scanning line corresponding to said viewing area of said two or more scanning lines, and not choosing other scanning lines when said 1st busy condition is detected by said busy condition detection means in an electro-optic device given in either among claim 4 thru/or claim 6.
[Claim 8] It sets to an electro-optic device given in either among claim 1 thru/or claim 7. The liquid crystal panel which

pinched the liquid crystal layer as said electro-optics layer between the substrates of said pair, The electro-optic device characterized by providing the reflective polarizing plate of the pair which makes the polarization which has the polarization shaft of the 2nd direction which is arranged at the both sides of said liquid crystal panel, and reflects the polarization which has the polarization shaft of the 1st direction, and is different from the 1st direction penetrate.
[Claim 9] The electro-optic device with which the reflective polarizing plate of said pair is characterized by being arranged between the absorption mold polarizing plates of the pair which absorbs the polarization which penetrates the polarization which has the polarization shaft of the 1st direction, and has the polarization shaft of the 2nd direction in an electro-optic device according to claim 8.
[Claim 10] It is attached in the body section, the covering device attached in this body section possible [closing motion], and this covering device. The electro-optic device which can display an image on the 1st and 2nd screens of the both sides of a covering device, In electronic equipment equipped with an input means to input image information into this electro-optic device An image can be checked by looking from both-sides side of the 2nd screen where said electro-optic device comes to have an electro-optics layer, and counters with the 1st screen and this 1st screen between the substrates of a pair. And electronic equipment characterized by having the driving means which changes the rate of the viewing area of the screen, and a non-display field according to the busy condition selectable and chosen [the 1st busy condition which checks said 1st screen by looking, and the 2nd busy condition which checks said 2nd screen by looking].

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the liquid crystal display of the double-sided display mold which can display an image especially on both sides, and the electronic equipment using it about the electronic equipment which used an electro-optic device and it.
[0002]
[Description of the Prior Art] Conventionally, the liquid crystal display which can display an image on both sides of a liquid crystal panel is proposed as a display of small and lightweight Personal Digital Assistants, such as a cellular phone and a luggable computer. There is a liquid crystal display which can display an image on both sides by arranging the liquid crystal panel of the transparency mold of two sheets back to back on both sides of a back light as one of the liquid crystal displays of such a double-sided display mold. Moreover, by arranging a reflecting plate to the another side side of the remaining part as a liquid crystal display of other double-sided display molds, while arranging a reflecting plate to some of one near liquid crystal panels of the reflective mold of one sheet, while enabling a display of a part by the another side side of a liquid crystal panel, there is a liquid crystal display of the double-sided display mold whose display of the part remaining by one side is enabled (refer to JP,10-198291,A).
[0003]
[Problem(s) to be Solved by the Invention] However, in the former liquid crystal display, it is necessary to use the liquid crystal panel of two sheets, components mark and weight increase, and there is a problem that thickness also becomes thick. Moreover, in the latter liquid crystal display, any [of a liquid crystal panel] near screens are only some fields of a liquid crystal panel, and since an image cannot be displayed over the whole surface of one [at least] screen, when much information needs to be displayed, there is a problem of not being enough.
[0004] In order to solve these problems, this invention persons have proposed the liquid crystal display of the double-sided display mold which can display an image over the whole surface of both sides of the liquid crystal panel of one sheet. However, a case so that information may always be displayed on the screen of the outside of a lid while the lid has closed, when using it, building the liquid crystal display of such a double-sided display mold into the lid of Personal Digital Assistants, such as a cellular phone, and when much information needs to be displayed in the condition of having opened although what is necessary is just to have displayed little information where a lid is closed, there is a problem that power consumption while having closed the lid will become large.
[0005] Then, this invention cancels the above-mentioned trouble and aims at offering the electronic equipment using the liquid crystal display and it which can display an image and can display an image on some fields in an another side side over the whole surface in one liquid crystal panel side of one sheet.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the electro-optic device by this invention An image can be checked by looking from both-sides side of the 2nd screen which counters with the 1st screen and this 1st screen in the electro-optic device which comes to have an electro-optics layer between the substrates of a pair. And it is characterized by having the driving means which changes the rate of the viewing area of the screen, and a non-display field according to the busy condition selectable and chosen [the 1st busy condition which checks said 1st screen by looking, and the 2nd busy condition which checks said 2nd screen by looking].
[0007] According to this electro-optic device, it can be used as an electro-optic device which can display an image on

both sides using the liquid crystal panel of one sheet, components mark and weight can be reduced compared with the liquid crystal display which displays an image on both sides using the liquid crystal panel of two sheets, and thickness can be made thin. Moreover, since the rate of a viewing area and a non-display field is changed and only a required part is displayed according to a busy condition, power consumption can be reduced.

[0008] In the electro-optic device of this invention, it is desirable to have a busy condition detection means to detect whether the 1st busy condition or the 2nd busy condition was chosen. According to the busy condition which this busy condition detection means detects, the rate of the viewing area of the screen and a non-display field can be changed by the driving means.

[0009] Two or more scanning lines are formed in the above-mentioned electro-optic device. Moreover, ** Two or more signal lines arranged so that said two or more scanning lines may be intersected are prepared. The display-control circuit where each pixel on said 1st and 2nd screens is formed in each location where two or more scanning lines and two or more signal lines cross, and a driving means controls image display, The scanning-line driver which is controlled by this display-control circuit and carries out sequential supply of the scan potential at two or more scanning lines, [whether it constitutes so that it may have with the signal-line driver which supplies the signal potential corresponding to each pixel which was controlled by the display-control circuit and connected to said two or more signal lines to coincidence, and] Or two or more signal lines arranged so that the above-mentioned electro-optic device may intersect two or more scanning lines and two or more scanning lines are prepared. The display-control circuit where each pixel on the 1st and 2nd screens is formed in each location where two or more scanning lines and two or more signal lines cross, and a driving means controls image display, It is controlled by this display-control circuit, and it can constitute so that it may have with the scanning-line driver which carries out sequential supply of the scan potential at two or more scanning lines, and the signal-line driver which supplies the signal potential corresponding to the pixel which was controlled by the display-control circuit and connected to two or more signal lines to coincidence.

[0010] When the 1st busy condition is detected by the busy condition detection means, a display-control circuit the above-mentioned electro-optic device A signal-line driver supplies the signal potential which turns OFF the screen to the signal line corresponding to the non-display field of two or more signal lines. By supplying the signal potential according to image data only to the signal line corresponding to a viewing area, when the 1st busy condition is detected by the busy condition detection means, a drive circuit It can constitute so that only the scanning line corresponding to the viewing area of two or more scanning lines may be chosen, and it may be made not to choose other scanning lines or it may act as the both sides.

[0011] Thus, by constituting, it can be set as the field of the request of the viewing area which is a part of 1st screen on the 1st screen, and the power consumption when enabling a display of an image and using the 1st screen only for the set-up viewing area can be reduced.

[0012] It is desirable when the reflective polarizing plate of the pair which makes the polarization which has the polarization shaft of the 2nd direction which is arranged at the both sides of the liquid crystal panel which pinched the liquid crystal layer as said electro-optics layer between the substrates of said pair, and said liquid crystal panel, and reflects the polarization which has the polarization shaft of the 1st direction, and is different from the 1st direction penetrate is provided, if it is in the electro-optic device of this invention mentioned above. Thus, with a reflective polarizing plate, if constituted, since the 1st screen and 2nd screen can be formed with a reflective polarizing plate, the electro-optic device of both sides of a liquid crystal panel which can display an image over the whole surface mostly will be realized. In addition, if it is in that case, when the reflective polarizing plate of said pair is arranged between the absorption mold polarizing plates of the pair which absorbs the polarization which penetrates the polarization which has the polarization shaft of the 1st direction, and has the polarization shaft of the 2nd direction, it is desirable. By arranging the absorption mold polarizing plate of a pair between reflective polarizing plates, it can prevent being able to absorb, before carrying out incidence of the polarization of the direction which intersects perpendicularly with the transparency shaft of a reflective polarizing plate to a reflective polarizing plate, and the polarization carrying out direct incidence to a reflective polarizing plate, and becoming the reflected light. Thus, by preventing unnecessary reflection, display contrast can be improved and a legible display can be realized.

[0013] Moreover, the covering device attached by the electronic equipment of this invention possible [closing motion in the body section and this body section], In electronic equipment equipped with an input means to be attached in this covering device and to input image information into the electro-optic device which can display an image on the 1st and 2nd screens of the both sides of a covering device, and this electro-optic device An image can be checked by looking

from both-sides side of the 2nd screen where said electro-optic device comes to have an electro-optics layer, and counters with the 1st screen and this 1st screen between the substrates of a pair. And it is characterized by having the driving means which changes the rate of the viewing area of the screen, and a non-display field according to the busy condition selectable and chosen [the 1st busy condition which checks said 1st screen by looking, and the 2nd busy condition which checks said 2nd screen by looking].

[0014] According to the electronic equipment of this invention, since an image can be displayed only on the required field of the screen according to the busy condition of electronic equipment, power consumption can be reduced.

[0015]

[Embodiment of the Invention] Hereafter, with reference to an accompanying drawing, the gestalt of operation of the electro-optic device of the double-sided display mold by this invention is explained.

[0016] Drawing 1 is the perspective view showing the gestalt of operation of the Personal Digital Assistant as electronic equipment equipped with the electro-optic device of the double-sided display mold by this invention, (a) shows the condition of having closed the Personal Digital Assistant, and (b) shows the condition of having opened the Personal Digital Assistant.

[0017] As shown in drawing 1 , Personal Digital Assistant 10 of this operation gestalt is equipped with the body section 12 and the covering device 14 attached in this body section 12 free [closing motion]. The input sections 16, such as a keyboard for inputting information, are formed in the body section 12, and the electro-optic device 18 is built into the covering device 14 as the image display section. In the gestalt of this operation, the liquid crystal display 18 is adopted as an electro-optic device. Window part 14a of a comparatively small abbreviation rectangle was formed in a part of external surface of a covering device 14, and a part of one field of a liquid crystal display 18 is exposed to it. On the other hand, window part 14b of a comparatively large abbreviation rectangle which occupies the most was formed in the inside of a covering device 14, and the field of another side of a liquid crystal display 18 is exposed to it. A liquid crystal display 18 consists of a liquid crystal display of the double-sided display mold which achieves the function as the image display section also in the state of any in the condition of having opened the covering device 14 shown in the condition and drawing 1 (b) which closed the covering device 14 shown in drawing 1 (a), i.e., the liquid crystal display of the double-sided display mold which has an image display side to both sides of a covering device 14. That is, where the covering device 14 shown in drawing 1 (a) is closed, one field of a liquid crystal display 18 achieves the function as the outside screen, and where the covering device 14 shown in drawing 1 (b) is opened, the field of another side of a liquid crystal display 18 achieves the function as the inside screen.

[0018] Moreover, a busy condition detection means 220 mention later to detect the switching condition of a covering device 14 is formed in the body section 12. As shown in drawing 1 (b), the busy condition detection means 220 is equipped with the spring which is prepared near the corner of the top face of the body section 12, and energizes up the pin 20 which can project up, and this pin 20 and which is not illustrated. That is, after the covering device 14 shown in drawing 1 (b) has opened, and the covering device 14 which a pin 20 shows up to a projection and drawing 1 (a) has closed, it is constituted so that a pin 20 may resist the energization force of a spring and may be held in the body section 12 by the covering device 14. Thus, it is constituted so that the location of a pin 20 can detect the switching condition of a covering device 14, i.e., the busy condition of Personal Digital Assistant 10. According to the busy condition of Personal Digital Assistant 10 detected by the busy condition detection means 220, one field of the liquid crystal displays 18 achieves the function as an image display side so that it may mention later. That is, the outside screen of the liquid crystal display 18 shown in drawing 1 R> 1 (b) when the condition that the covering device 14 opened is detected becomes usable, and when the condition that the covering device 14 closed is detected, the inside screen of the liquid crystal display 18 shown in drawing 1 (a) becomes usable.

[0019] In addition, Personal Digital Assistant 10 includes the circuit where the sources of a display information output which are not illustrated, display information processing circuits, clock generation circuits, etc. are various, the power circuit which supplies a power source to those circuits besides the configuration of having mentioned above. Moreover, as electronic equipment equipped with the liquid crystal display of the double-sided display mold by this invention, various electronic equipment, such as a portable telephone, a wrist watch, a luggable computer, a notebook sized personal computer, an electronic notebook, a pager, a calculator, a POS terminal, an IC card, and a minidisc player, is applicable.

[0020] Drawing 2 is the perspective view showing the gestalt of other operations of the Personal Digital Assistant as electronic equipment equipped with the liquid crystal display of the double-sided display mold by this invention, (a)

shows the condition of having closed the Personal Digital Assistant, and (b) shows the condition of having opened the Personal Digital Assistant.

[0021] As shown in drawing 2 , with Personal Digital Assistant 110 of this operation gestalt, it differs from Personal Digital Assistant 10 of the operation gestalt mentioned above at the point which is the window part of a comparatively large abbreviation rectangle in which the window parts 114a and 114b formed in the external surface and inside of a covering device 114 all occupy most of external surface of a covering device 114, and insides. It consists of this operation gestalt so that only the part shown with a slash by drawing 2 (a) among the fields of the outside of the liquid crystal display 18 exposed by window part 114a of the external surface of a covering device 114 can be used as the outside screen. In this case, the outside screen of a liquid crystal display 18 may constitute so that it may become only the part shown with this slash, and it may constitute so that it may become all the parts exposed by the part alternatively shown with a slash, or window part 114a. Since other configurations are the same as that of the operation gestalt of drawing 1 mentioned above, in drawing 2 , 1 is given at least to that of 100 of the reference mark of drawing 1 , and the explanation is omitted.

[0022] Next, the gestalt of operation of the liquid crystal display of the double-sided display mold by this invention applicable to Personal Digital Assistant 10,110 shown in drawing 1 and drawing 2 which were mentioned above is explained. Drawing 3 R> 3 is the sectional view showing the liquid crystal display of this operation gestalt. As shown in drawing 3 , the liquid crystal display 18 is equipped with the liquid crystal panel 22 arranged so that the substrates 24 and 32 of a pair may counter mutually through the spacer for cel gap control which is not illustrated. Two or more transparent electrodes 26 and 30 which estrange mutually as the scanning line and a signal line to the field which counters the substrate of another side, respectively, and are prolonged in parallel in it are formed in these substrates 24 and 32. These transparent electrodes 26 and 30 are arranged so that it may cross mutually, and they form the liquid crystal panel 22 of a simple matrix (passive matrix) mold. The sealant 34 is applied to the periphery section of the field where the substrates 24 and 32 of a pair counter, and the substrate 24 and TN liquid crystal layer 28 with which it fills up among 32 are closed by this sealant 34. In addition, when the linearly polarized light which carried out incidence to TN liquid crystal layer 28 in the condition of not impressing electric field to a liquid crystal panel passes TN liquid crystal layer 28, the thickness of TN liquid crystal layer 28 is set up so that 90 degrees of the phase may shift. Moreover, in order to give explanation easy, drawing 3 and other same drawings mentioned later expand and show the dimension of a lengthwise direction (the height direction) compared with the lateral dimension, and the gaps between the substrates 24 and 32 of a pair are several micrometers thru/or dozens of micrometers.

[0023] The 1st reflective polarizing plate 36 is arranged at one liquid crystal panel 22 side, and the 2nd reflective polarizing plate 38 is arranged at the another side side. Moreover, the 1st absorption mold polarizing plate 40 is arranged at a side [external surface / of the 1st reflective polarizing plate 36 /, i.e., are far from a liquid crystal panel 22,], and the 2nd absorption mold polarizing plate 42 is arranged at the side [external surface / of the 2nd reflective polarizing plate 38 /, i.e., are far from a liquid crystal panel 22,].

[0024] The reflective polarizer which consists of a multilayer-structure film indicated for example, in international public presentation (WO 95/17692) can constitute the 1st and 2nd reflective polarizing plates 36 and 38. As shown in drawing 4 , this multilayer-structure film has the multilayer structure which carried out the laminating of two kinds of different layers which carried out extension formation of the polymer, for example, the A horizon which consists of polyethylenenaphthalate, and the B horizon which consists of copolymerization ester of naphthalene dicarboxylic acid and a terephthalic acid to Z shaft orientations by turns. Each class of an A horizon and a B horizon is 1 micrometer or less in thickness, and the thickness of the whole multilayer-structure film is about 200 micrometers.

[0025] The refractive index (nAX) of X shaft orientations of the A horizon of a reflective polarizer and the refractive index (nAY) of Y shaft orientations which consist of a multilayer-structure film are set up so that it may differ mutually, and the refractive index (nBX) of X shaft orientations of a B horizon and the refractive index (nBY) of Y shaft orientations are set up so that abbreviation etc. may be spread and may become mutually. Moreover, the refractive index (nAY) of Y shaft orientations of an A horizon and the refractive index (nBY) of Y shaft orientations of a B horizon are set up so that abbreviation etc. may be spread and may become mutually. Therefore, the relation of (nAX)! =(nAY) and (nBX)**(nBY)**(nAY) among these refractive indexes is. Thus, since there is no difference of a refractive index between each class substantially, the linearly polarized light which has the polarization shaft of Y shaft orientations among the light which carried out incidence to the 1st and 2nd formed reflective polarizing plates 36 and 38 is penetrated as it is.

[0026] Moreover, thickness of Z shaft orientations of the A horizon of an adjoining pair and a B horizon is set to tA and tB, respectively, and wavelength of incident light is set to lambda, If it sets up so that the relation of the following formulas (1) may be filled The linearly polarized light which has the polarization shaft of X shaft orientations among the light of the wavelength lambda which carried out incidence to the 1st and 2nd reflective polarizing plates 36 and 38 is reflected as the linearly polarized light which has the polarization shaft of X shaft orientations in the interface of an adjoining A horizon and a B horizon.

[0027]

TA-nAX+tB-nBX**lambda/2 (1)

Furthermore, if the thickness tA and tB of each of a pair of A horizon and a B horizon is set up so that the thickness tA and tB of each of a pair of adjoining A horizon and a B horizon may be changed and the relation of the above-mentioned formula (1) may be filled covering the wide range wavelength lambda of a light field The 1st and 2nd reflective polarizing plates 36 and 38 can be made to reflect the linearly polarized light which has the polarization shaft of X shaft orientations among the white lights which carried out incidence as the linearly polarized light of the direction.

[0028] Therefore, the 1st and 2nd reflective polarizing plates 36 and 38 reflect the linearly polarized light which has the polarization shaft of X shaft orientations as the linearly polarized light of the direction, and make the linearly polarized light which has the polarization shaft of Y shaft orientations penetrate as the linearly polarized light of the direction in all light fields.

[0029] Moreover, the 1st and 2nd absorption mold polarizing plates 40 and 42 penetrate polarization parallel to transparency shaft orientations, are polarizing plates which absorb polarization of the absorption shaft orientations which intersect perpendicularly with transparency shaft orientations, for example, are formed by using dichroism matter, such as iodine and a color. Moreover, the 1st absorption mold polarizing plate 40 is arranged so that the transparency shaft may become the transparency shaft of the 1st reflective polarizing plate 36, and abbreviation parallel, and the 2nd absorption mold polarizing plate 42 is arranged so that the transparency shaft may become the transparency shaft of the 2nd reflective polarizing plate 38, and abbreviation parallel. Therefore, the 1st and 2nd absorption mold polarizing plates 40 and 42 make polarization which penetrates the 1st and 2nd reflective polarizing plates 36 and 38, respectively penetrate as it is, and absorb polarization which is reflected by the 1st and 2nd reflective polarizing plates 36 and 38. Therefore, it can prevent that it is absorbed with the 1st or 2nd absorption mold polarizing plate 40 and 42 before carrying out incidence of the polarization of the direction which intersects perpendicularly with the transparency shaft of the 1st or 2nd reflective polarizing plate 36 and 38 to the 1st or 2nd reflective polarizing plate 36 and 38, the polarization carries out direct incidence to the 1st or 2nd reflective polarizing plate 36 and 38, and it turns into the reflected light. Thus, by preventing unnecessary reflection, display contrast can be improved and a legible display can be realized.

[0030] Furthermore, with this operation gestalt, the 1st reflective polarizing plate 36 and the 1st absorption mold polarizing plate 40 are arranged so that those transparency shafts may become the transparency shaft of the 2nd reflective polarizing plate 38 and the 2nd absorption mold polarizing plate 42, and abbreviation parallel.

[0031] Next, the actuation in the case of using the liquid crystal display 18 constituted as mentioned above as a reflective mold liquid crystal display under a bright light with reference to drawing 5 is explained. In addition, the case where 90-degree rotation (rotatory polarization) of the polarization shaft of the linearly polarized light which passes a liquid crystal panel 22 is carried out when drawing 5 (a) does not impress electric field to a liquid crystal panel 22 is shown, and drawing 5 (b) shows the case where the polarization shaft of the linearly polarized light passed liquid crystal panel 22 is not rotated, when impressing electric field to a liquid crystal panel 22. Moreover, in drawing 5 , an asterisk shows the outdoor daylight which does not have polarization shafts, such as the white light, the arrow head of a longitudinal direction shows the linearly polarized light which has a polarization shaft parallel to space, and the notation which drew the small black dot into the round head shows the linearly polarized light which has a polarization shaft perpendicular to space.

[0032] First, when shown in the left-hand side of drawing 5 (a), the case where outdoor daylight 60 carries out incidence to the field in the condition of rotating 90 degrees of polarization shafts of the linearly polarized light which passes a liquid crystal panel 22, from the 1st absorption mold polarizing plate 40 side is explained. In this case, the polarization component of the direction of absorption shaft 40A of the 1st absorption mold polarizing plate 40 is absorbed with the 1st absorption mold polarizing plate 40, only the polarization component of the direction of

transparency shaft 40T of the 1st absorption mold polarizing plate 40 penetrates the 1st absorption mold polarizing plate 40, and the outdoor daylight 60 which carried out incidence carries out outgoing radiation as linearly polarized light 60a which has the polarization shaft of that direction of transparency shaft 40T. this linearly polarized light 60a -- transparency shaft 40T and abbreviation for the 1st absorption mold polarizing plate 40 -- the 1st reflective polarizing plate 36 which has parallel transparency shaft 36T is penetrated as it is, and a liquid crystal panel 22 is passed further. 90 degrees of polarization shafts of the linearly polarized light which passed the liquid crystal panel 22 rotate, they are set to linearly polarized light 60b, and carry out incidence to the 2nd reflective polarizing plate 38. Since the polarization shaft is reflective shaft 38R of the 2nd reflective polarizing plate 38, and abbreviation parallel, linearly polarized light 60b which carried out incidence to the 2nd reflective polarizing plate 38 is reflected by the 2nd reflective polarizing plate 38. reflected linearly polarized light 60c -- reflective shaft 38R of the 2nd reflective polarizing plate 38 -- abbreviation -- it has an parallel polarization shaft and incidence is carried out to a liquid crystal panel 22. Linearly polarized light 60c which carried out incidence to the liquid crystal panel 22 90 degrees of the polarization shaft rotate with a liquid crystal panel 22, and it becomes 60d of linearly polarized lights which have a polarization shaft parallel to transparency shaft 36T of the 1st reflective polarizing plate 36. the 1st reflective polarizing plate 36 -- as it is -- penetrating -- further -- transparency shaft 36T and abbreviation for the 1st reflective polarizing plate 36 -- the 1st absorption mold polarizing plate 40 which has parallel transparency shaft 40T is penetrated, and the near screen of the 1st absorption polarizing plate 40 is reached.

[0033] (moreover, when shown in the right-hand side of drawing 5 (a) (i.e., also when outdoor daylight 61 carries out incidence to the field which 90 degrees of polarization shafts of the linearly polarized light which passes a liquid crystal panel 22 rotate from the 2nd absorption mold polarizing plate 42 side), and also when) The outdoor daylight 61 which carried out incidence to the 2nd absorption mold polarizing plate 42 reaches the near screen of the 2nd absorption mold polarizing plate 42 like the above-mentioned case as 61d of the linearly polarized lights parallel to transparency shaft 42T of the 2nd absorption mold polarizing plate 42.

[0034]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the liquid crystal display of the double-sided display mold which can display an image especially on both sides, and the electronic equipment using it about the electronic equipment which used an electro-optic device and it.

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PRIOR ART

[Description of the Prior Art] Conventionally, the liquid crystal display which can display an image on both sides of a liquid crystal panel is proposed as a display of small and lightweight Personal Digital Assistants, such as a cellular phone and a luggable computer. There is a liquid crystal display which can display an image on both sides by arranging the liquid crystal panel of the transparency mold of two sheets back to back on both sides of a back light as one of the liquid crystal displays of such a double-sided display mold. Moreover, by arranging a reflecting plate to the another side side of the remaining part as a liquid crystal display of other double-sided display molds, while arranging a reflecting plate to some of one near liquid crystal panels of the reflective mold of one sheet, while enabling a display of a part by the another side side of a liquid crystal panel, there is a liquid crystal display of the double-sided display mold whose display of the part remaining by one side is enabled (refer to JP,10-198291,A).

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the former liquid crystal display, it is necessary to use the liquid crystal panel of two sheets, components mark and weight increase, and there is a problem that thickness also becomes thick. Moreover, in the latter liquid crystal display, any [of a liquid crystal panel] near screens are only some fields of a liquid crystal panel, and since an image cannot be displayed over the whole surface of one [at least] screen, when much information needs to be displayed, there is a problem of not being enough.
[0004] In order to solve these problems, this invention persons have proposed the liquid crystal display of the double-sided display mold which can display an image over the whole surface of both sides of the liquid crystal panel of one sheet. However, a case so that information may always be displayed on the screen of the outside of a lid while the lid has closed, when using it, building the liquid crystal display of such a double-sided display mold into the lid of Personal Digital Assistants, such as a cellular phone, and when much information needs to be displayed in the condition of having opened although what is necessary is just to have displayed little information where a lid is closed, there is a problem that power consumption while having closed the lid will become large.
[0005] Then, this invention cancels the above-mentioned trouble and aims at offering the electronic equipment using the liquid crystal display and it which can display an image and can display an image on some fields in an another side side over the whole surface in one liquid crystal panel side of one sheet.

[Translation done.]

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MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the electro-optic device by this invention An image can be checked by looking from both-sides side of the 2nd screen which counters with the 1st screen and this 1st screen in the electro-optic device which comes to have an electro-optics layer between the substrates of a pair. And it is characterized by having the driving means which changes the rate of the viewing area of the screen, and a non-display field according to the busy condition selectable and chosen [the 1st busy condition which checks said 1st screen by looking, and the 2nd busy condition which checks said 2nd screen by looking].
[0007] According to this electro-optic device, it can be used as an electro-optic device which can display an image on both sides using the liquid crystal panel of one sheet, components mark and weight can be reduced compared with the liquid crystal display which displays an image on both sides using the liquid crystal panel of two sheets, and thickness can be made thin. Moreover, since the rate of a viewing area and a non-display field is changed and only a required part is displayed according to a busy condition, power consumption can be reduced.
[0008] In the electro-optic device of this invention, it is desirable to have a busy condition detection means to detect whether the 1st busy condition or the 2nd busy condition was chosen. According to the busy condition which this busy condition detection means detects, the rate of the viewing area of the screen and a non-display field can be changed by the driving means.
[0009] Two or more scanning lines are formed in the above-mentioned electro-optic device. Moreover, ** Two or more signal lines arranged so that said two or more scanning lines may be intersected are prepared. The display-control circuit where each pixel on said 1st and 2nd screens is formed in each location where two or more scanning lines and two or more signal lines cross, and a driving means controls image display, The scanning-line driver which is controlled by this display-control circuit and carries out sequential supply of the scan potential at two or more scanning lines, [whether it constitutes so that it may have with the signal-line driver which supplies the signal potential corresponding to each pixel which was controlled by the display-control circuit and connected to said two or more signal lines to coincidence, and] Or two or more signal lines arranged so that the above-mentioned electro-optic device may intersect two or more scanning lines and two or more scanning lines are prepared. The display-control circuit where each pixel on the 1st and 2nd screens is formed in each location where two or more scanning lines and two or more signal lines cross, and a driving means controls image display, It is controlled by this display-control circuit, and it can constitute so that it may have with the scanning-line driver which carries out sequential supply of the scan potential at two or more scanning lines, and the signal-line driver which supplies the signal potential corresponding to the pixel which was controlled by the display-control circuit and connected to two or more signal lines to coincidence.
[0010] When the 1st busy condition is detected by the busy condition detection means, a display-control circuit the above-mentioned electro-optic device A signal-line driver supplies the signal potential which turns OFF the screen to the signal line corresponding to the non-display field of two or more signal lines. By supplying the signal potential according to image data only to the signal line corresponding to a viewing area, when the 1st busy condition is detected by the busy condition detection means, a drive circuit It can constitute so that only the scanning line corresponding to the viewing area of two or more scanning lines may be chosen, and it may be made not to choose other scanning lines or it may act as the both sides.
[0011] Thus, by constituting, it can be set as the field of the request of the viewing area which is a part of 1st screen on the 1st screen, and the power consumption when enabling a display of an image and using the 1st screen only for the set-up viewing area can be reduced.

[0012] It is desirable when the reflective polarizing plate of the pair which makes the polarization which has the polarization shaft of the 2nd direction which is arranged at the both sides of the liquid crystal panel which pinched the liquid crystal layer as said electro-optics layer between the substrates of said pair, and said liquid crystal panel, and reflects the polarization which has the polarization shaft of the 1st direction, and is different from the 1st direction penetrate is provided, if it is in the electro-optic device of this invention mentioned above. Thus, with a reflective polarizing plate, if constituted, since the 1st screen and 2nd screen can be formed with a reflective polarizing plate, the electro-optic device of both sides of a liquid crystal panel which can display an image over the whole surface mostly will be realized. In addition, if it is in that case, when the reflective polarizing plate of said pair is arranged between the absorption mold polarizing plates of the pair which absorbs the polarization which penetrates the polarization which has the polarization shaft of the 1st direction, and has the polarization shaft of the 2nd direction, it is desirable. By arranging the absorption mold polarizing plate of a pair between reflective polarizing plates, it can prevent being able to absorb, before carrying out incidence of the polarization of the direction which intersects perpendicularly with the transparency shaft of a reflective polarizing plate to a reflective polarizing plate, and the polarization carrying out direct incidence to a reflective polarizing plate, and becoming the reflected light. Thus, by preventing unnecessary reflection, display contrast can be improved and a legible display can be realized.

[0013] Moreover, the covering device attached by the electronic equipment of this invention possible [closing motion in the body section and this body section], In electronic equipment equipped with an input means to be attached in this covering device and to input image information into the electro-optic device which can display an image on the 1st and 2nd screens of the both sides of a covering device, and this electro-optic device An image can be checked by looking from both-sides side of the 2nd screen where said electro-optic device comes to have an electro-optics layer, and counters with the 1st screen and this 1st screen between the substrates of a pair. And it is characterized by having the driving means which changes the rate of the viewing area of the screen, and a non-display field according to the busy condition selectable and chosen [the 1st busy condition which checks said 1st screen by looking, and the 2nd busy condition which checks said 2nd screen by looking].

[0014] According to the electronic equipment of this invention, since an image can be displayed only on the required field of the screen according to the busy condition of electronic equipment, power consumption can be reduced.

[0015]

[Embodiment of the Invention] Hereafter, with reference to an accompanying drawing, the gestalt of operation of the electro-optic device of the double-sided display mold by this invention is explained.

[0016] Drawing 1 is the perspective view showing the gestalt of operation of the Personal Digital Assistant as electronic equipment equipped with the electro-optic device of the double-sided display mold by this invention, (a) shows the condition of having closed the Personal Digital Assistant, and (b) shows the condition of having opened the Personal Digital Assistant.

[0017] As shown in drawing 1 , Personal Digital Assistant 10 of this operation gestalt is equipped with the body section 12 and the covering device 14 attached in this body section 12 free [closing motion]. The input sections 16, such as a keyboard for inputting information, are formed in the body section 12, and the electro-optic device 18 is built into the covering device 14 as the image display section. In the gestalt of this operation, the liquid crystal display 18 is adopted as an electro-optic device. Window part 14a of a comparatively small abbreviation rectangle was formed in a part of external surface of a covering device 14, and a part of one field of a liquid crystal display 18 is exposed to it. On the other hand, window part 14b of a comparatively large abbreviation rectangle which occupies the most was formed in the inside of a covering device 14, and the field of another side of a liquid crystal display 18 is exposed to it. A liquid crystal display 18 consists of a liquid crystal display of the double-sided display mold which achieves the function as the image display section also in the state of any in the condition of having opened the covering device 14 shown in the condition and drawing 1 (b) which closed the covering device 14 shown in drawing 1 (a), i.e., the liquid crystal display of the double-sided display mold which has an image display side to both sides of a covering device 14. That is, where the covering device 14 shown in drawing 1 (a) is closed, one field of a liquid crystal display 18 achieves the function as the outside screen, and where the covering device 14 shown in drawing 1 (b) is opened, the field of another side of a liquid crystal display 18 achieves the function as the inside screen.

[0018] Moreover, a busy condition detection means 220 mention later to detect the switching condition of a covering device 14 is formed in the body section 12. As shown in drawing 1 (b), the busy condition detection means 220 is equipped with the spring which is prepared near the corner of the top face of the body section 12, and energizes up the

pin 20 which can project up, and this pin 20 and which is not illustrated. That is, after the covering device 14 shown in drawing 1 (b) has opened, and the covering device 14 which a pin 20 shows up to a projection and drawing 1 (a) has closed, it is constituted so that a pin 20 may resist the energization force of a spring and may be held in the body section 12 by the covering device 14. Thus, it is constituted so that the location of a pin 20 can detect the switching condition of a covering device 14, i.e., the busy condition of Personal Digital Assistant 10. According to the busy condition of Personal Digital Assistant 10 detected by the busy condition detection means 220, one field of the liquid crystal displays 18 achieves the function as an image display side so that it may mention later. That is, the outside screen of the liquid crystal display 18 shown in drawing 1 R> 1 (b) when the condition that the covering device 14 opened is detected becomes usable, and when the condition that the covering device 14 closed is detected, the inside screen of the liquid crystal display 18 shown in drawing 1 (a) becomes usable.

[0019] In addition, Personal Digital Assistant 10 includes the circuit where the sources of a display information output which are not illustrated, display information processing circuits, clock generation circuits, etc. are various, the power circuit which supplies a power source to those circuits besides the configuration of having mentioned above. Moreover, as electronic equipment equipped with the liquid crystal display of the double-sided display mold by this invention, various electronic equipment, such as a portable telephone, a wrist watch, a luggable computer, a notebook sized personal computer, an electronic notebook, a pager, a calculator, a POS terminal, an IC card, and a minidisc player, is applicable.

[0020] Drawing 2 is the perspective view showing the gestalt of other operations of the Personal Digital Assistant as electronic equipment equipped with the liquid crystal display of the double-sided display mold by this invention, (a) shows the condition of having closed the Personal Digital Assistant, and (b) shows the condition of having opened the Personal Digital Assistant.

[0021] As shown in drawing 2 , with Personal Digital Assistant 110 of this operation gestalt, it differs from Personal Digital Assistant 10 of the operation gestalt mentioned above at the point which is the window part of a comparatively large abbreviation rectangle in which the window parts 114a and 114b formed in the external surface and inside of a covering device 114 all occupy most of external surface of a covering device 114, and insides. It consists of this operation gestalt so that only the part shown with a slash by drawing 2 (a) among the fields of the outside of the liquid crystal display 18 exposed by window part 114a of the external surface of a covering device 114 can be used as the outside screen. In this case, the outside screen of a liquid crystal display 18 may constitute so that it may become only the part shown with this slash, and it may constitute so that it may become all the parts exposed by the part alternatively shown with a slash, or window part 114a. Since other configurations are the same as that of the operation gestalt of drawing 1 mentioned above, in drawing 2 , 1 is given at least to that of 100 of the reference mark of drawing 1 , and the explanation is omitted.

[0022] Next, the gestalt of operation of the liquid crystal display of the double-sided display mold by this invention applicable to Personal Digital Assistant 10,110 shown in drawing 1 and drawing 2 which were mentioned above is explained. Drawing 3 R> 3 is the sectional view showing the liquid crystal display of this operation gestalt. As shown in drawing 3 , the liquid crystal display 18 is equipped with the liquid crystal panel 22 arranged so that the substrates 24 and 32 of a pair may counter mutually through the spacer for cel gap control which is not illustrated. Two or more transparent electrodes 26 and 30 which estrange mutually as the scanning line and a signal line to the field which counters the substrate of another side, respectively, and are prolonged in parallel in it are formed in these substrates 24 and 32. These transparent electrodes 26 and 30 are arranged so that it may cross mutually, and they form the liquid crystal panel 22 of a simple matrix (passive matrix) mold. The sealant 34 is applied to the periphery section of the field where the substrates 24 and 32 of a pair counter, and the substrate 24 and TN liquid crystal layer 28 with which it fills up among 32 are closed by this sealant 34. In addition, when the linearly polarized light which carried out incidence to TN liquid crystal layer 28 in the condition of not impressing electric field to a liquid crystal panel passes TN liquid crystal layer 28, the thickness of TN liquid crystal layer 28 is set up so that 90 degrees of the phase may shift. Moreover, in order to give explanation easy, drawing 3 and other same drawings mentioned later expand and show the dimension of a lengthwise direction (the height direction) compared with the lateral dimension, and the gaps between the substrates 24 and 32 of a pair are several micrometers thru/or dozens of micrometers.

[0023] The 1st reflective polarizing plate 36 is arranged at one liquid crystal panel 22 side, and the 2nd reflective polarizing plate 38 is arranged at the another side side. Moreover, the 1st absorption mold polarizing plate 40 is arranged at a side [external surface / of the 1st reflective polarizing plate 36 /, i.e., are far from a liquid crystal panel

22,], and the 2nd absorption mold polarizing plate 42 is arranged at the side [external surface / of the 2nd reflective polarizing plate 38 /, i.e., are far from a liquid crystal panel 22,].
[0024] The reflective polarizer which consists of a multilayer-structure film indicated for example, in international public presentation (WO 95/17692) can constitute the 1st and 2nd reflective polarizing plates 36 and 38. As shown in drawing 4 , this multilayer-structure film has the multilayer structure which carried out the laminating of two kinds of different layers which carried out extension formation of the polymer, for example, the A horizon which consists of polyethylenenaphthalate, and the B horizon which consists of copolymerization ester of naphthalene dicarboxylic acid and a terephthalic acid to Z shaft orientations by turns. Each class of an A horizon and a B horizon is 1 micrometer or less in thickness, and the thickness of the whole multilayer-structure film is about 200 micrometers.
[0025] The refractive index (nAX) of X shaft orientations of the A horizon of a reflective polarizer and the refractive index (nAY) of Y shaft orientations which consist of a multilayer-structure film are set up so that it may differ mutually, and the refractive index (nBX) of X shaft orientations of a B horizon and the refractive index (nBY) of Y shaft orientations are set up so that abbreviation etc. may be spread and may become mutually. Moreover, the refractive index (nAY) of Y shaft orientations of an A horizon and the refractive index (nBY) of Y shaft orientations of a B horizon are set up so that abbreviation etc. may be spread and may become mutually. Therefore, the relation of (nAX)! =(nAY) and (nBX)**(nBY)**(nAY) among these refractive indexes is. Thus, since there is no difference of a refractive index between each class substantially, the linearly polarized light which has the polarization shaft of Y shaft orientations among the light which carried out incidence to the 1st and 2nd formed reflective polarizing plates 36 and 38 is penetrated as it is.
[0026] Moreover, thickness of Z shaft orientations of the A horizon of an adjoining pair and a B horizon is set to tA and tB, respectively, and wavelength of incident light is set to lambda, If it sets up so that the relation of the following formulas (1) may be filled The linearly polarized light which has the polarization shaft of X shaft orientations among the light of the wavelength lambda which carried out incidence to the 1st and 2nd reflective polarizing plates 36 and 38 is reflected as the linearly polarized light which has the polarization shaft of X shaft orientations in the interface of an adjoining A horizon and a B horizon.
[0027]
TA-nAX+tB-nBX**lambda/2 (1)
Furthermore, if the thickness tA and tB of each of a pair of A horizon and a B horizon is set up so that the thickness tA and tB of each of a pair of adjoining A horizon and a B horizon may be changed and the relation of the above-mentioned formula (1) may be filled covering the wide range wavelength lambda of a light field The 1st and 2nd reflective polarizing plates 36 and 38 can be made to reflect the linearly polarized light which has the polarization shaft of X shaft orientations among the white lights which carried out incidence as the linearly polarized light of the direction.
[0028] Therefore, the 1st and 2nd reflective polarizing plates 36 and 38 reflect the linearly polarized light which has the polarization shaft of X shaft orientations as the linearly polarized light of the direction, and make the linearly polarized light which has the polarization shaft of Y shaft orientations penetrate as the linearly polarized light of the direction in all light fields.
[0029] Moreover, the 1st and 2nd absorption mold polarizing plates 40 and 42 penetrate polarization parallel to transparency shaft orientations, are polarizing plates which absorb polarization of the absorption shaft orientations which intersect perpendicularly with transparency shaft orientations, for example, are formed by using dichroism matter, such as iodine and a color. Moreover, the 1st absorption mold polarizing plate 40 is arranged so that the transparency shaft may become the transparency shaft of the 1st reflective polarizing plate 36, and abbreviation parallel, and the 2nd absorption mold polarizing plate 42 is arranged so that the transparency shaft may become the transparency shaft of the 2nd reflective polarizing plate 38, and abbreviation parallel. Therefore, the 1st and 2nd absorption mold polarizing plates 40 and 42 make polarization which penetrates the 1st and 2nd reflective polarizing plates 36 and 38, respectively penetrate as it is, and absorb polarization which is reflected by the 1st and 2nd reflective polarizing plates 36 and 38. Therefore, it can prevent that it is absorbed with the 1st or 2nd absorption mold polarizing plate 40 and 42 before carrying out incidence of the polarization of the direction which intersects perpendicularly with the transparency shaft of the 1st or 2nd reflective polarizing plate 36 and 38 to the 1st or 2nd reflective polarizing plate 36 and 38, the polarization carries out direct incidence to the 1st or 2nd reflective polarizing plate 36 and 38, and it turns into the reflected light. Thus, by preventing unnecessary reflection, display contrast can be improved and a legible

display can be realized.
[0030] Furthermore, with this operation gestalt, the 1st reflective polarizing plate 36 and the 1st absorption mold polarizing plate 40 are arranged so that those transparency shafts may become the transparency shaft of the 2nd reflective polarizing plate 38 and the 2nd absorption mold polarizing plate 42, and abbreviation parallel.
[0031] Next, the actuation in the case of using the liquid crystal display 18 constituted as mentioned above as a reflective mold liquid crystal display under a bright light with reference to drawing 5 is explained. In addition, the case where 90-degree rotation (rotatory polarization) of the polarization shaft of the linearly polarized light which passes a liquid crystal panel 22 is carried out when drawing 5 (a) does not impress electric field to a liquid crystal panel 22 is shown, and drawing 5 (b) shows the case where the polarization shaft of the linearly polarized light passed liquid crystal panel 22 is not rotated, when impressing electric field to a liquid crystal panel 22. Moreover, in drawing 5 , an asterisk shows the outdoor daylight which does not have polarization shafts, such as the white light, the arrow head of a longitudinal direction shows the linearly polarized light which has a polarization shaft parallel to space, and the notation which drew the small black dot into the round head shows the linearly polarized light which has a polarization shaft perpendicular to space.
[0032] First, when shown in the left-hand side of drawing 5 (a), the case where outdoor daylight 60 carries out incidence to the field in the condition of rotating 90 degrees of polarization shafts of the linearly polarized light which passes a liquid crystal panel 22, from the 1st absorption mold polarizing plate 40 side is explained. In this case, the polarization component of the direction of absorption shaft 40A of the 1st absorption mold polarizing plate 40 is absorbed with the 1st absorption mold polarizing plate 40, only the polarization component of the direction of transparency shaft 40T of the 1st absorption mold polarizing plate 40 penetrates the 1st absorption mold polarizing plate 40, and the outdoor daylight 60 which carried out incidence carries out outgoing radiation as linearly polarized light 60a which has the polarization shaft of that direction of transparency shaft 40T. this linearly polarized light 60a -- transparency shaft 40T and abbreviation for the 1st absorption mold polarizing plate 40 -- the 1st reflective polarizing plate 36 which has parallel transparency shaft 36T is penetrated as it is, and a liquid crystal panel 22 is passed further. 90 degrees of polarization shafts of the linearly polarized light which passed the liquid crystal panel 22 rotate, they are set to linearly polarized light 60b, and carry out incidence to the 2nd reflective polarizing plate 38. Since the polarization shaft is reflective shaft 38R of the 2nd reflective polarizing plate 38, and abbreviation parallel, linearly polarized light 60b which carried out incidence to the 2nd reflective polarizing plate 38 is reflected by the 2nd reflective polarizing plate 38. reflected linearly polarized light 60c -- reflective shaft 38R of the 2nd reflective polarizing plate 38 -- abbreviation -- it has an parallel polarization shaft and incidence is carried out to a liquid crystal panel 22. Linearly polarized light 60c which carried out incidence to the liquid crystal panel 22 90 degrees of the polarization shaft rotate with a liquid crystal panel 22, and it becomes 60d of linearly polarized lights which have a polarization shaft parallel to transparency shaft 36T of the 1st reflective polarizing plate 36. the 1st reflective polarizing plate 36 -- as it is -- penetrating -- further -- transparency shaft 36T and abbreviation for the 1st reflective polarizing plate 36 -- the 1st absorption mold polarizing plate 40 which has parallel transparency shaft 40T is penetrated, and the near screen of the 1st absorption polarizing plate 40 is reached.
[0033] (moreover, when shown in the right-hand side of drawing 5 (a) (i.e., also when outdoor daylight 61 carries out incidence to the field which 90 degrees of polarization shafts of the linearly polarized light which passes a liquid crystal panel 22 rotate from the 2nd absorption mold polarizing plate 42 side), and also when) The outdoor daylight 61 which carried out incidence to the 2nd absorption mold polarizing plate 42 reaches the near screen of the 2nd absorption mold polarizing plate 42 like the above-mentioned case as 61d of the linearly polarized lights parallel to transparency shaft 42T of the 2nd absorption mold polarizing plate 42.
[0034] Thus, the outdoor daylight which carried out incidence to the field in the condition of rotating 90 degrees of polarization shafts of the linearly polarized light which passes a liquid crystal panel 22 In order that it may be reflected with the 1st or 2nd reflective polarizing plate 36 and 38 and the most may carry out outgoing radiation in a path contrary to incident light, Even when outdoor daylight carries out incidence from which [of the 1st or 2nd absorption mold polarizing plate 40 and.42] side, the field in the condition of rotating 90 degrees of polarization shafts of the linearly polarized light which passes a liquid crystal panel 22 serves as a bright white display.
[0035] Next, when shown in the left-hand side of drawing 5 (b), the case where outdoor daylight 62 carries out incidence to the field in the condition of not rotating the polarization shaft of the linearly polarized light which passes a liquid crystal panel 22, from the 1st absorption mold polarizing plate 40 side is explained. In this case, as for the

outdoor daylight 62 which carried out incidence, the polarization component of the direction of absorption shaft 40A of the 1st absorption mold polarizing plate 40 is absorbed with the 1st absorption mold polarizing plate 40. The polarization component of the direction of transparency shaft 40T of the 1st absorption mold polarizing plate 40 penetrates the 1st absorption mold polarizing plate 40, and carries out outgoing radiation from the 1st absorption mold polarizing plate 40 as linearly polarized light 62a which has the polarization shaft of the direction of transparency shaft 40T. The 1st reflective polarizing plate 36 which has parallel transparency shaft 36T is penetrated as it is. this linearly polarized light 60a -- transparency shaft 40T and abbreviation for the 1st absorption mold polarizing plate 40 -- The 2nd reflective polarizing plate 38 which has parallel transparency shaft 38T is penetrated. without it rotates a polarization shaft -- a liquid crystal panel 22 -- passing -- transparency shaft 40T and abbreviation for the 1st absorption mold polarizing plate 40 -- transparency shaft 38T and abbreviation for the 2nd reflective polarizing plate 38 -- the 2nd absorption mold polarizing plate 42 which has parallel transparency shaft 42T is penetrated, and it goes on as it is, and does not return to the near screen of the 1st absorption mold polarizing plate 40.

[0036] (moreover, when shown in the right-hand side of drawing 5 (b) (i.e., also when outdoor daylight 63 carries out incidence to the field in the condition of not rotating the polarization shaft of the linearly polarized light which passes a liquid crystal panel 22, from the 2nd absorption mold polarizing plate 42 side), and also when) Like the above-mentioned case, the outdoor daylight 63 which carried out incidence to the 2nd absorption mold polarizing plate 42 penetrates the 1st absorption mold polarizing plate 40 as polarization 63a parallel to transparency shaft 40T of the 1st absorption mold polarizing plate 40, and outgoing radiation is carried out as it is, and it does not return to the incidence side which is the screen.

[0037] Thus, since the outdoor daylight which carried out incidence to the field in the condition of not rotating the polarization shaft of the linearly polarized light which passes a liquid crystal panel 22 is penetrated to a reverse side and does not return to an incidence side with an incidence side, even when outdoor daylight carries out incidence from which [of the 1st or 2nd absorption mold polarizing plate 40 and 42] side, the field in the condition do not rotate the polarization shaft of the linearly polarized light which passes a liquid crystal panel 22 serves as a dark display.

[0038] As mentioned above, the liquid crystal display 18 of this operation gestalt The field in the condition of rotating 90 degrees of polarization shafts of the linearly polarized light which passes a liquid crystal panel 22 when using it as a reflective mold liquid crystal display under bright outdoor daylight The field in the condition of not rotating the polarization shaft of the linearly polarized light which serves as a bright white viewing area even when which [of a liquid crystal panel 22] side is used as the screen, and passes a liquid crystal panel 22 Even when which [of a liquid crystal panel] side is used as the screen, it becomes a dark viewing area, and a double-sided display can be performed. In addition, a liquid crystal panel 22 can be changed into the middle condition in the condition of not making it rotating with the condition of rotating 90 degrees of polarization shafts of the linearly polarized light to pass, and can perform a halftone display.

[0039] As mentioned above, the liquid crystal display 18 of this operation gestalt can be used using the liquid crystal panel 22 of one sheet as a reflective mold liquid crystal display which can display an image on both sides, can reduce components mark and weight compared with the liquid crystal display which displays an image on both sides using the liquid crystal panel of two sheets, and can make thickness thin. Moreover, in a liquid crystal display 18, since it can be used as a reflective mold liquid crystal display on which the reflective polarizing plates 36 and 38 arranged over the whole surface of both sides of a liquid crystal panel 22 act as a reflecting plate, an image can be displayed on both sides over the whole surface of a liquid crystal panel 22. Furthermore, since the 1st and 2nd reflective polarizing plates 36 and 38 can reflect most polarization which has the polarization shaft of a predetermined direction, they serve as a bright reflective mold liquid crystal display.

[0040] Although the above-mentioned example is a liquid crystal display with TN liquid crystal panel of a passive-matrix mold, the same effectiveness is acquired even if it is the liquid crystal display with TN liquid crystal panel of the active-matrix mold of two terminals or three terminals.

[0041] Drawing 6 is the sectional view showing the gestalt of other operations of the liquid crystal display of the double-sided display mold by this invention applicable to Personal Digital Assistant 10,110 shown in drawing 1 and drawing 2 . As shown in drawing 6 R> 6, in addition to the configuration of the liquid crystal display 18 of the operation gestalt shown in drawing 3 , in the liquid crystal display 118 of this operation gestalt, the scattering layer 44 which has the function which light is scattered and is diffused is arranged a liquid crystal panel 22, the 2nd reflective polarizing plate 38, and in between. It prevents that this scattering layer 44 serves as a display image which is the light

in which the display image corresponding to the part reflected with the 2nd reflective polarizing plate 38 was reflected by the mirror plane, and it is used in order to use as the display image near paper White the display image corresponding to the part reflected with the 2nd reflective polarizing plate 38. A scattering layer 44 can be formed by making a bead mix into the glue line which consists of plastic film which distributed the bead and consists of optical adhesives on which a liquid crystal panel 22 and the 2nd reflective polarizing plate 38 are pasted up. In addition, a scattering layer 44 may be arranged [between not only between a liquid crystal panel 22 and the 2nd reflective polarizing plate 38 but the liquid crystal panel 22, and the 1st reflective polarizing plate 36 / between the 1st reflective polarizing plate 36 and the 1st absorption mold polarizing plate 40] to any by the side of the external surface of the 1st absorption mold polarizing plate 40 or the 2nd absorption mold polarizing plate 42 between the 2nd reflective polarizing plate 38 and the 2nd absorption mold polarizing plate 42. Moreover, since the polarization shaft of the linearly polarized light which penetrated the scattering layer 44 does not change, the behavior of light which carries out incidence to the liquid crystal panel 22 as shown in drawing 5 is not affected. Since other configurations are the same as that of the operation gestalt shown in drawing 3 , in drawing 6 , the same sign is given to the part corresponding to the liquid crystal display 18 of the operation gestalt of drawing 3 , and the explanation is omitted.

[0042] Drawing 7 is the sectional view of the liquid crystal display of the double-sided display mold by this invention applicable to Personal Digital Assistant 10,110 shown in drawing 1 and drawing 2 showing the gestalt of other operations further. As shown in drawing 7 , in the liquid crystal display 218 of this operation gestalt While using the liquid crystal panel 122 which closed the STN LCD layer 128 instead of the liquid crystal panel 22 which the liquid crystal displays 18 and 118 of the operation gestalt shown in drawing 3 and drawing 6 closed TN liquid crystal layer 28 In order to cancel the coloring generated with this STN type of liquid crystal panel 122, the phase contrast plates 46 and 46 are formed between the 1st reflective polarizing plate 36 and the 1st absorption mold polarizing plate 40 and between the 2nd reflective polarizing plate 38 and the 2nd absorption mold polarizing plate 42. Moreover, the include angle between the transparency shafts of the 1st reflective polarizing plate 36, the transparency shaft of the 1st absorption mold polarizing plate 40 and the 2nd reflective polarizing plate 38, and the 2nd absorption mold polarizing plate 42 is the point determined according to the twist angle of the liquid crystal panel 122 of a STN mold, and differs from the case of the operation gestalt of drawing 3 which uses the liquid crystal panel 22 of TN mold. Furthermore, actuation of the liquid crystal display 218 of this operation gestalt is the same as that of the operation gestalt of drawing 3 which mentioned above the phase shift by the liquid crystal panel 122 of a STN mold except for the point compensated with the phase contrast plates 46 and 46. Since other configurations are the same as that of the operation gestalt shown in drawing 6 , in drawing 7 , the same sign is given to the part corresponding to the liquid crystal display 118 of the operation gestalt of drawing 6 , and the explanation is omitted. In addition, if coloring by the liquid crystal panel 122 of a STN mold does not become a problem, it is not necessary to necessarily form the phase contrast plates 46 and 46 or, and you may make it prepare only one side of the phase contrast plates 46 and 46.

[0043] Moreover, in the liquid crystal display 18,118,218 of the operation gestalt shown in drawing 3 , drawing 6 , or drawing 7 , the light absorption layer which is not most illustrated to one side by the side of external surface may be arranged removable. Since this light absorption layer absorbs the outdoor daylight which carries out incidence to the 1st [of a side], or 2nd absorption mold polarizing plate 40 and 42 which a light absorption layer arranges while absorbing the light which penetrated the 1st or 2nd reflective polarizing plate 36 and 38 which functions as a reflecting plate, when the side which does not have this light absorption layer is used as the screen, it can improve contrast.

[0044] As mentioned above, the liquid crystal display 18 (118 218) of the double-sided display mold shown in drawing 3 , drawing 6 , and drawing 7 It is the configuration which displays an image over the whole surface of both sides of a liquid crystal panel 22 (122). In applying to Personal Digital Assistant 10 (110) of the operation gestalt which shows such a liquid crystal display 18 (118 218) to drawing 1 and drawing 2 When having closed the covering device 14 (114), it is not necessary to display an image over the whole surface of the outside screen of a liquid crystal display 18 (118 218). Moreover, power consumption will become large, if an image is displayed over the whole surface of the outside screen of a liquid crystal display 18 (118 218) also when having closed the covering device 14 (114). So, in this invention, only some fields of the outside screen of a liquid crystal display 18 (118 218) are made into a display condition, other fields are changed into a non-display condition, and power consumption is reduced. Moreover, it is at the outside display and inside display time, and reversal of an image can be prevented by changing font rotation and a scanning direction.

[0045] Hereafter, the gestalt of operation of the drive circuit of the liquid crystal display by this invention which can

make a display condition only some fields of the outside screen of a liquid crystal display 18 (118 218) in this way is explained.
[0046] Drawing 8 is the block diagram showing the gestalt of operation of the drive circuit of the liquid crystal display 18 (118 218) by this invention.
[0047] As shown in drawing 8 , the drive circuit 210 of the liquid crystal display 18 (118 218) of this operation gestalt The display control 211 which controls image display, and the scanning-line driver 212 which carries out sequential supply of the scan potential with the shift register controlled by this display-control circuit 211 at two or more scanning lines 26, and performs line sequential scanning, It has the signal-line driver 213 which supplies the signal potential corresponding to the image data of each pixel to two or more signal lines 30 with the shift register controlled by the display-control circuit 211 to each pixel chosen by this scan driver 212.
[0048] The scan potential supplied to the scanning line 26 by the scanning-line driver 212 and the signal potential supplied to a signal line 30 by the signal-line driver 213 are generated by the liquid crystal potential generation circuit 200, and is supplied to the scanning-line driver 212 and the signal-line driver 213, respectively.
[0049] Moreover, the drive circuit 210 Only the shadow area on the left-hand side of the liquid crystal display 18 (118 218) shown in drawing 9 (a) is made into a viewing area. Like [in the case of making other fields into a non-display field by making into a viewing area only the shadow area of the liquid crystal display 18 (118 218) top which shows other fields to the case where it considers as a non-display field, and drawing 9 (b)] It is constituted so that other fields can be made into a non-display field by making some liquid crystal displays 18 (118 218) into a viewing area. That is, when making into a viewing area only the field shown in drawing 9 (a) with a slash like the approach currently indicated by JP,6-95621,A, the drive circuit 210 transmits the data according to image data to the part corresponding to the viewing area of the shift register of the screen signal-line driver 213 of a liquid crystal display 18 (118 218), and transmits off-data to the part corresponding to a non-display field. thus, it is constituted so that it may come out and the power consumption for a data transfer may be reduced.
[0050] Moreover, when making into a viewing area only the field shown in drawing 9 (b) with a slash, it is constituted so that power consumption may be reduced, as only the scanning line 26 corresponding to an upper viewing area is chosen and other scanning lines 26 are not chosen.
[0051] Or you may make it reduce the power consumption of a liquid crystal display 18 (118 218) by using the approach indicated by Japanese Patent Application No. 9-518751 of the approaches of the common knowledge indicated by JP,7-281632,A, or this invention persons, making only some fields of the outside screen of a liquid crystal display 18 (118 218) into a display condition, and changing other fields into a non-display condition.
[0052] As mentioned above, since a part of screen of a liquid crystal display was made into the viewing area and other parts were made into the non-display field, the power consumption of a liquid crystal display can be reduced with the liquid crystal display of the double-sided display mold by this invention.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The perspective view showing the gestalt of operation of the Personal Digital Assistant as electronic equipment equipped with the liquid crystal display of the double-sided display mold by this invention.
[Drawing 2] The schematic diagram showing the gestalt of other operations of the Personal Digital Assistant as electronic equipment equipped with the liquid crystal display of the double-sided display mold by this invention.
[Drawing 3] The sectional view showing the gestalt of operation of the liquid crystal display of the double-sided display mold by this invention.
[Drawing 4] The perspective view showing roughly the reflective polarizer which consists of a multilayer-structure film used as a reflective polarizing plate of the liquid crystal display of the double-sided display mold of the gestalt of operation shown in drawing 3 .
[Drawing 5] The explanatory view of actuation of the liquid crystal display of the double-sided display mold shown in drawing 3 .
[Drawing 6] The sectional view showing the gestalt of other operations of the liquid crystal display of the double-sided display mold by this invention.
[Drawing 7] The sectional view of the liquid crystal display of the double-sided display mold by this invention showing the gestalt of other operations further.
[Drawing 8] The block diagram showing the gestalt of operation of the drive circuit of the liquid crystal display of the double-sided display mold by this invention.
[Drawing 9] It is the schematic diagram showing the viewing area and non-display field of the outside screen of a double-sided display mold by this invention. [of a liquid crystal display]
[Description of Notations]
10,110 Personal Digital Assistant
12,112 Body section
14,114 Covering device
16,116 Input section
18 (118 218) Liquid crystal display
20,120 Pin
22,122 Liquid crystal panel
24 32 Substrate
26 Transparent Electrode (Scanning Line)
28 TN Liquid Crystal Layer
30 Transparent Electrode (Signal Line)
34 Sealant
36 1st Reflective Polarizing Plate
38 2nd Reflective Polarizing Plate
40 1st Absorption Mold Polarizing Plate
42 2nd Absorption Mold Polarizing Plate
44 Scattering Layer
46 Phase Contrast Plate

128 STN LCD Layer
200 Liquid Crystal Potential Generation Circuit
210 Drive Circuit
211 Display-Control Circuit
212 Scanning-Line Driver
213 Signal-Line Driver
220 Busy Condition Detection Means

[Translation done.]

* NOTICES *

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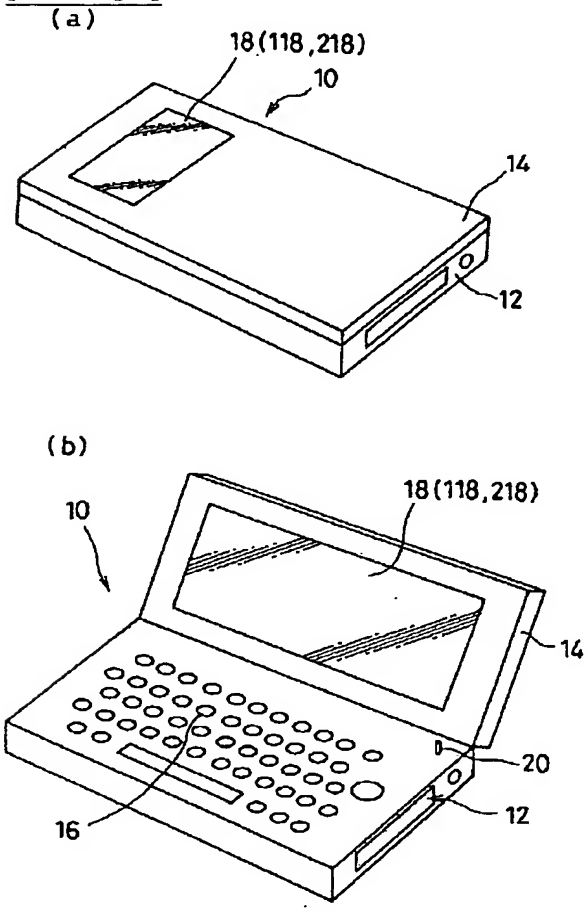
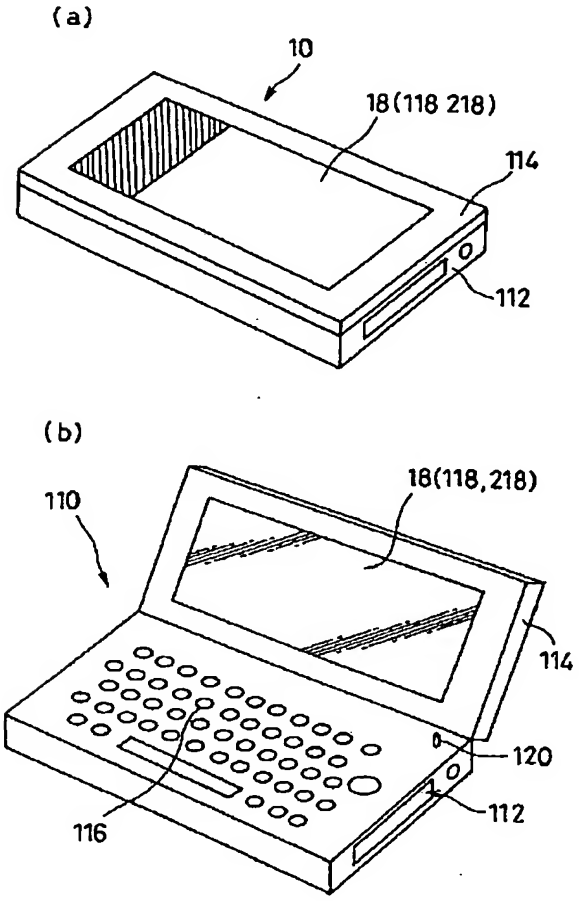
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



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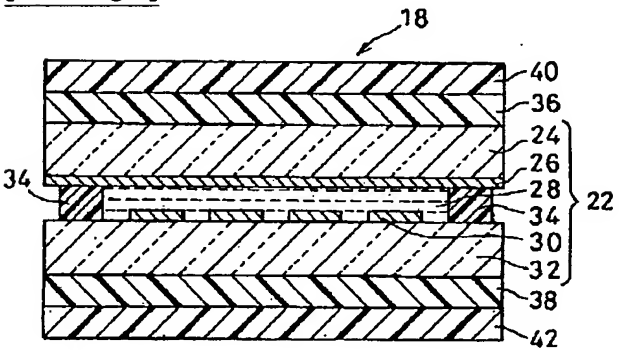

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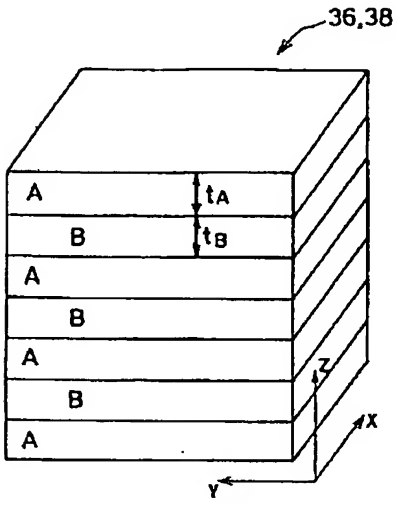

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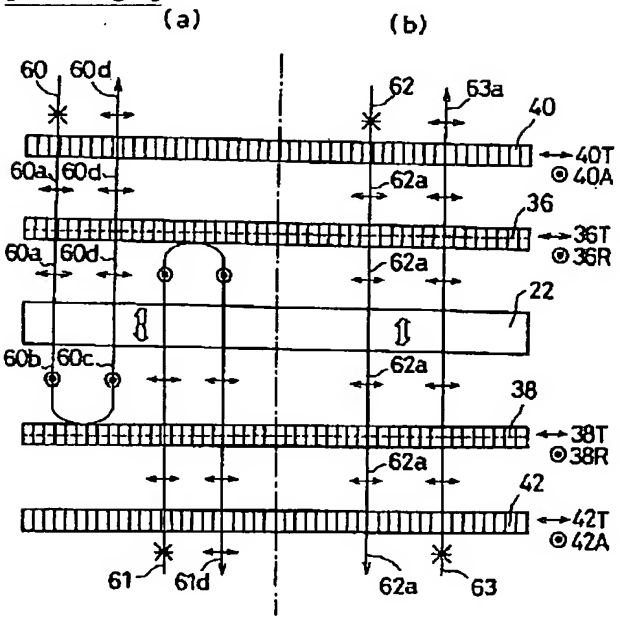

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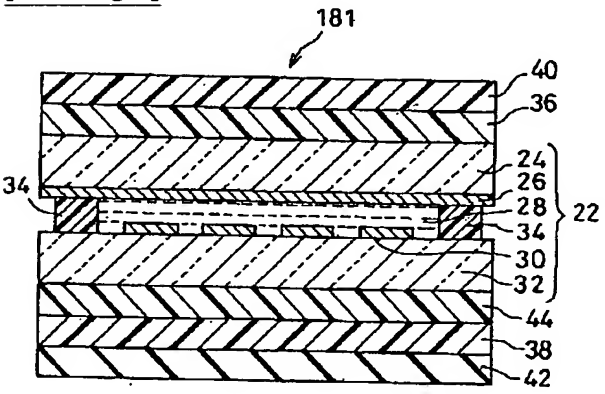
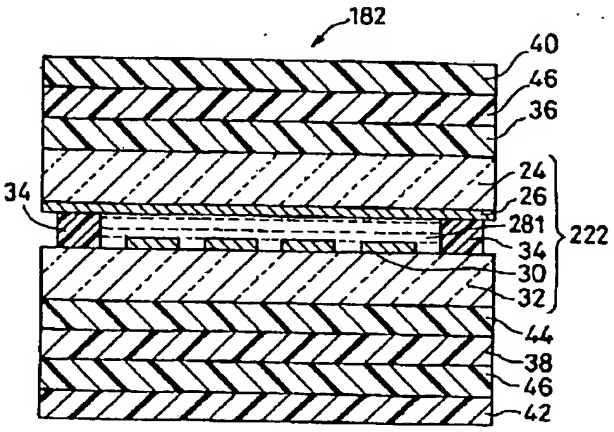
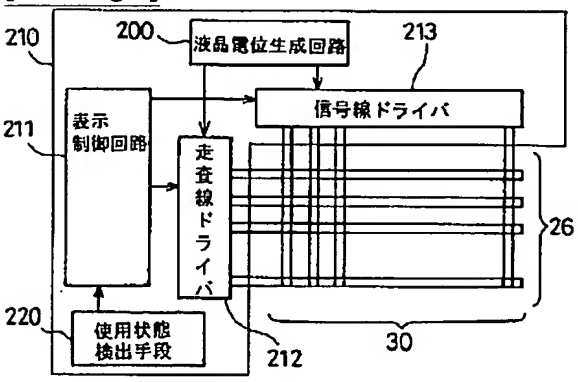


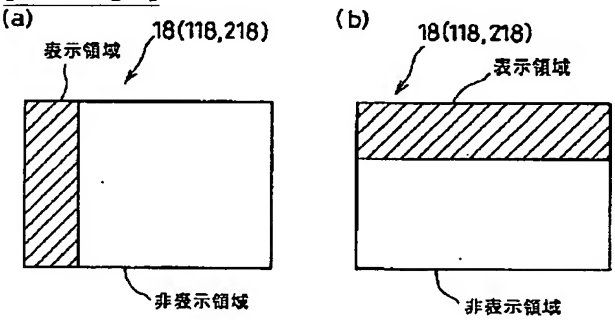
[Drawing 7]



[Drawing 8]



[Drawing 9]



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	1/1335	５１０		1/1335	５１０	２Ｈ０９３
	1/13363			1/13363		５Ｃ００６
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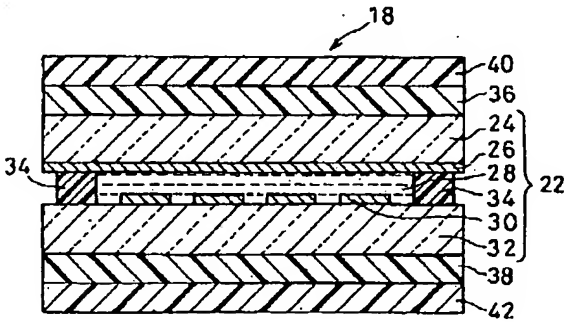
最終頁に続く

(54)【発明の名称】　電気光学装置およびそれを用いた電子機器

(57)【要約】　（修正有）
【課題】　１枚の液晶パネルの一方の側では全面に他方の側では一部の面に画像を表示可能な液晶表示装置及びそれを用いた電子機器を提供する。
【解決手段】　両面表示型の液晶表示装置１８は、一対の基板２４、３２の間に液晶層２８を挟んだ液晶パネル２２と、液晶パネルの両側に配置され、第１の方向の偏光軸を有する偏光を反射し且つ第１の方向と異なる第２の方向の偏光軸を有する偏光を透過させて、液晶パネルの両側に画像を表示可能な第１及び第２の表示面を形成する一対の反射偏光板３６、３８と、第１の表示面に画像を表示する第１の使用状態と第２の表示面に画像を表示する第２の使用状態とを検出する使用状態検出手段と、第１の使用状態が検出されたときに、第１の表示面の一部の領域を表示領域とし且つ第１の表示面の他の領域を非表示領域にし、第２の使用状態が検出されたときに、第２の表示面の全面を表示領域とする駆動回路を有する。



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【特許請求の範囲】

【請求項1】　一対の基板間に電気光学層を有してなる電気光学装置において、

第1の表示面及び該第1の表示面と対向する第2の表示面の両面側から画像を視認でき、且つ、前記第1の表示面を視認する第1の使用状態と前記第2の表示面を視認する第2の使用状態を選択可能であり、

選択された使用状態に応じて、表示面の表示領域と非表示領域の割合を切り替える駆動手段を有することを特徴とする電気光学装置。

【請求項2】　請求項1に記載の電気光学装置において、

前記第1の使用状態と前記第2の使用状態のいずれかが選択されたのかを検出する使用状態検出手段を備えることを特徴とする電気光学装置。

【請求項3】　請求項2に記載の電気光学装置において、

前記駆動手段が、前記使用状態検出手段によって前記第1の使用状態が検出されたときに、前記第1の表示面の一部の領域を表示領域とし且つ前記第1の表示面の他の領域を非表示領域として、前記表示領域のみに画像を表示可能にすることを特徴とする電気光学装置。

【請求項4】　請求項1乃至請求項3のうちいずれかに記載の電気光学装置において、

複数の走査線が設けられとともに、前記複数の走査線と交差するように配置された複数の信号線が設けられて、前記複数の走査線と前記複数の信号線が交差する各々の位置に前記第1および第2の表示面上の各々の画素を形成し、

前記駆動手段が、画像表示を制御する表示制御回路と、この表示制御回路によって制御されて前記複数の走査線に走査電位を順次供給する走査線ドライバと、前記表示制御回路によって制御されて前記複数の信号線に接続された各々の画素に対応する信号電位を同時に供給する信号線ドライバと備えたことを特徴とする電気光学装置。

【請求項5】　請求項1乃至請求項3のうちいずれかに記載の電気光学装置において、

複数の走査線と、前記複数の走査線と交差するように配置された複数の信号線が設けられて、前記複数の走査線と前記複数の信号線が交差する各々の位置に前記第1および第2の表示面上の各々の画素を形成し、

前記駆動手段が、画像表示を制御する表示制御回路と、この表示制御回路によって制御されて前記複数の走査線に走査電位を順次供給する走査線ドライバと、前記表示制御回路によって制御されて前記複数の信号線に接続された画素に対応する信号電位を同時に供給する信号線ドライバと備えたことを特徴とする電気光学装置。

【請求項6】　請求項4又は請求項5に記載の電気光学装置において、

前記表示制御回路が、前記使用状態検出手段によって前

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記第1の使用状態が検出されたときに、前記信号線ドライバが、前記複数の信号線のうちの前記非表示領域に対応する信号線に前記表示面をオフにする信号電位を供給し、前記表示領域に対応する信号線のみに画像データに応じた信号電位を供給することを特徴とする電気光学装置。

【請求項7】　請求項4乃至請求項6のうちいずれかに記載の電気光学装置において、

前記表示制御回路が、前記使用状態検出手段によって前記第1の使用状態が検出されたときに、前記複数の走査線のうちの前記表示領域に対応する走査線のみを選択して他の走査線を選択しないことを特徴とする電気光学装置。

【請求項8】　請求項1乃至請求項7のうちいずれかに記載の電気光学装置において、

前記一対の基板間に前記電気光学層として液晶層を挟持した液晶パネルと、

前記液晶パネルの両側に配置され、第1の方向の偏光軸を有する偏光を反射し且つ第1の方向と異なる第2の方向の偏光軸を有する偏光を透過させる一対の反射偏光板と、を具備することを特徴とする電気光学装置。

【請求項9】　請求項8に記載の電気光学装置において、

前記一対の反射偏光板が、第1の方向の偏光軸を有する偏光を透過し且つ第2の方向の偏光軸を有する偏光を吸収する一対の吸収型偏光板の間に配置されることを特徴とする電気光学装置。

【請求項10】　本体部と、この本体部に開閉可能に取付けられた蓋部と、この蓋部に取付けられて蓋部の両側の第1および第2の表示面に画像を表示可能な電気光学装置と、この電気光学装置に画像情報を入力する入力手段とを備えた電子機器において、前記電気光学装置が、一対の基板間に電気光学層を有してなり、

第1の表示面及び該第1の表示面と対向する第2の表示面の両面側から画像を視認でき、且つ、前記第1の表示面を視認する第1の使用状態と前記第2の表示面を視認する第2の使用状態を選択可能であり、

選択された使用状態に応じて、表示面の表示領域と非表示領域の割合を切り替える駆動手段を有することを特徴とする電子機器。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、電気光学装置およびそれを用いた電子機器に関し、特に両面に画像を表示可能な両面表示型の液晶表示装置およびそれを用いた電子機器に関する。

【0002】

【従来の技術】従来、携帯電話や携帯用コンピュータなどの小型・軽量の携帯情報端末の表示装置として、液晶パネルの両面に画像を表示可能な液晶表示装置が提案さ

れている。このような両面表示型の液晶表示装置の一つとして、バックライトを挟んで2枚の透過型の液晶パネルを背中合わせに配置することによって両面に画像を表示可能な液晶表示装置がある。また、他の両面表示型の液晶表示装置として、1枚の反射型の液晶パネルの一方の側の一部に反射板を配置するとともに残りの部分の他方の側に反射板を配置することによって、液晶パネルの他方の側で一部を表示可能にするとともに一方の側で残りの部分を表示可能にする両面表示型の液晶表示装置がある（特開平10-198291号参照）。

【0003】

【発明が解決しようとする課題】しかし、前者の液晶表示装置では、2枚の液晶パネルを使用する必要があり、部品点数および重量が増加し、厚さも厚くなるという問題がある。また、後者の液晶表示装置では、液晶パネルのいずれの側の表示面も液晶パネルの一部の面だけであり、少なくとも一方の表示面の全面にわたって画像を表示することができないため、多くの情報を表示する必要がある場合には十分でないという問題がある。

【0004】これらの問題を解消するため、本発明者らは、1枚の液晶パネルの両面の全面にわたって画像を表示可能な両面表示型の液晶表示装置を提案している。しかし、このような両面表示型の液晶表示装置を携帯電話などの携帯情報端末の蓋に組み込んで使用する場合において、蓋が閉じている間に蓋の外側の表示面に常に情報を表示するような場合や、蓋を閉じた状態では少ない情報を表示すればよいが開いた状態では多くの情報を表示する必要がある場合には、蓋を閉じている間の消費電力が大きくなってしまうという問題がある。

【0005】そこで、本発明は、上記の問題点を解消し、1枚の液晶パネルの一方の側では全面にわたって画像を表示可能であり且つ他方の側では一部の面に画像を表示可能な液晶表示装置およびそれを用いた電子機器を提供することを目的とする。

【0006】

【課題を解決するための手段】上記の目的を達成するため、本発明による電気光学装置は、一対の基板間に電気光学層を有してなる電気光学装置において、第1の表示面及び該第1の表示面と対向する第2の表示面の両面側から画像を視認でき、且つ、前記第1の表示面を視認する第1の使用状態と前記第2の表示面を視認する第2の使用状態を選択可能であり、選択された使用状態に応じて、表示面の表示領域と非表示領域の割合を切り替える駆動手段を有することを特徴とする。

【0007】この電気光学装置によれば、1枚の液晶パネルを使用して両面に画像を表示可能な電気光学装置として使用することができ、2枚の液晶パネルを使用して両面に画像を表示する液晶表示装置と比べて、部品点数および重量を削減し、厚さを薄くすることができる。また、使用状態に応じて、表示領域と非表示領域の割合を切り替えて必要な部分だけを表示するため消費電力を低減することができる。

【0008】本発明の電気光学装置においては、第1の使用状態と第2の使用状態のいずれかが選択されたのかを検出する使用状態検出手段を備えていることが好ましい。この使用状態検出手段が検出する使用状態に応じ、表示面の表示領域と非表示領域の割合を駆動手段によって切り替えることができる。

【0009】また、上記の電気光学装置において、複数の走査線が設けられとともに、前記複数の走査線と交差するように配置された複数の信号線が設けられて、複数の走査線と複数の信号線が交差する各々の位置に前記第1および第2の表示面上の各々の画素を形成し、駆動手段が、画像表示を制御する表示制御回路と、この表示制御回路によって制御されて複数の走査線に走査電位を順次供給する走査線ドライバと、表示制御回路によって制御されて前記複数の信号線に接続された各々の画素に対応する信号電位を同時に供給する信号線ドライバと備えるように構成するか、あるいは、上記電気光学装置が、複数の走査線と、複数の走査線と交差するように配置された複数の信号線が設けられて、複数の走査線と複数の信号線が交差する各々の位置に第1および第2の表示面上の各々の画素を形成し、駆動手段が、画像表示を制御する表示制御回路と、この表示制御回路によって制御されて複数の走査線に走査電位を順次供給する走査線ドライバと、表示制御回路によって制御されて複数の信号線に接続された画素に対応する信号電位を同時に供給する信号線ドライバと備えるように構成できる。

【0010】上記の電気光学装置は、表示制御回路が、使用状態検出手段によって第1の使用状態が検出されたときに、信号線ドライバが、複数の信号線のうちの非表示領域に対応する信号線に表示面をオフにする信号電位を供給し、表示領域に対応する信号線のみに画像データに応じた信号電位を供給するか、あるいは駆動回路が、使用状態検出手段によって第1の使用状態が検出されたときに、複数の走査線のうちの表示領域に対応する走査線のみを選択して他の走査線を選択しないようにするか、またはその双方をするように構成できる。

【0011】このように構成することにより、第1の表示面の一部である表示領域を第1の表示面上の所望の領域に設定することができ、設定された表示領域のみに画像を表示可能にして、第1の表示面を使用するときの消費電力を低減することができる。

【0012】上述してきた本発明の電気光学装置にあっては、前記一対の基板間に前記電気光学層として液晶層を挟持した液晶パネルと、前記液晶パネルの両側に配置され、第1の方向の偏光軸を有する偏光を反射し且つ第1の方向と異なる第2の方向の偏光軸を有する偏光を透過させる一対の反射偏光板と、を具備すると好ましい。このように構成すれば、反射偏光板によって、第1の表

示面及び第２の表示面を反射偏光板によって形成できるので、液晶パネルの両面のほぼ全面にわたって画像を表示することができる電気光学装置が実現する。尚、その場合にあっては、前記一対の反射偏光板が、第１の方向の偏光軸を有する偏光を透過し且つ第２の方向の偏光軸を有する偏光を吸収する一対の吸収型偏光板の間に配置されると好ましい。一対の吸収型偏光板を反射偏光板間に配置することにより、反射偏光板の透過軸と直交する方向の偏光を反射偏光板に入射する前に吸収することができ、その偏光が反射偏光板に直接入射して反射光となるのを防止することができる。このように不必要な反射を防止することによって、表示コントラストを改善し、見やすい表示を実現することができる。

【００１３】また、本発明の電子機器は、本体部と、この本体部に開閉可能に取付けられた蓋部と、この蓋部に取付けられて蓋部の両側の第１および第２の表示面に画像を表示可能な電気光学装置と、この電気光学装置に画像情報を入力する入力手段とを備えた電子機器において、前記電気光学装置が、一対の基板間に電気光学層を有してなり、第１の表示面及び該第１の表示面と対向する第２の表示面の両面側から画像を視認でき、且つ、前記第１の表示面を視認する第１の使用状態と前記第２の表示面を視認する第２の使用状態を選択可能であり、選択された使用状態に応じて、表示面の表示領域と非表示領域の割合を切り替える駆動手段を有することを特徴とする。

【００１４】本発明の電子機器によれば、電子機器の使用状態に応じて表示面の必要な領域のみに画像を表示できるので消費電力を低減できる。

【００１５】

【発明の実施の形態】以下、添付図面を参照して、本発明による両面表示型の電気光学装置の実施の形態を説明する。

【００１６】図１は、本発明による両面表示型の電気光学装置を備えた電子機器としての携帯情報端末の実施の形態を示す斜視図であり、（ａ）は携帯情報端末を閉じた状態を示し、（ｂ）は携帯情報端末を開いた状態を示している。

【００１７】図１に示すように、本実施形態の携帯情報端末１０は、本体部１２と、この本体部１２に開閉自在に取付けられた蓋部１４とを備えている。本体部１２には、情報を入力するためのキーボードなどの入力部１６が設けられ、蓋部１４には、画像表示部として、電気光学装置１８が組み込まれている。本実施の形態においては、電気光学装置として液晶表示装置１８を採用している。蓋部１４の外面の一部には、比較的小さい略矩形の窓部１４ａが形成されて、液晶表示装置１８の一方の面の一部を露出している。一方、蓋部１４の内面には、その大部分を占有するような比較的大きい略矩形の窓部１４ｂが形成されて、液晶表示装置１８の他方の面を露出している。液晶表示装置１８は、図１（ａ）に示す蓋部１４を閉じた状態および図１（ｂ）に示す蓋部１４を開いた状態のいずれの状態でも画像表示部としての機能を果たす両面表示型の液晶表示装置、すなわち蓋部１４の両面に画像表示面を有する両面表示型の液晶表示装置からなる。すなわち、図１（ａ）に示す蓋部１４を閉じた状態では、液晶表示装置１８の一方の面が外側表示面としての機能を果たし、図１（ｂ）に示す蓋部１４を開いた状態では、液晶表示装置１８の他方の面が内側表示面としての機能を果たす。

【００１８】また、本体部１２には、蓋部１４の開閉状態を検出する後述する使用状態検出手段２２０が設けられている。図１（ｂ）に示すように、使用状態検出手段２２０は、本体部１２の上面の角部付近に設けられて上方に突出可能なピン２０と、このピン２０を上方に付勢する図示しないバネを備えている。すなわち、図１（ｂ）に示す蓋部１４が開いた状態では、ピン２０が上方に突出し、図１（ａ）に示す蓋部１４が閉じた状態では、ピン２０が蓋部１４によってバネの付勢力に抗して本体部１２内に収容されるように構成されている。このようにして、ピン２０の位置によって蓋部１４の開閉状態すなわち携帯情報端末１０の使用状態を検出できるように構成されている。後述するように、使用状態検出手段２２０によって検出された携帯情報端末１０の使用状態に応じて、液晶表示装置１８のいずれか一方の面が画像表示面としての機能を果たすようになっている。すなわち、蓋部１４が開いた状態が検出されたときには、図１（ｂ）に示す液晶表示装置１８の外側表示面が使用可能になり、蓋部１４が閉じた状態が検出されたときには、図１（ａ）に示す液晶表示装置１８の内側表示面が使用可能になる。

【００１９】なお、携帯情報端末１０は、上述した構成の他に、図示しない表示情報出力源、表示情報処理回路、クロック発生回路などの様々な回路や、それらの回路に電源を供給する電源回路などを含んでいる。また、本発明による両面表示型の液晶表示装置を備えた電子機器としては、携帯電話機、腕時計、携帯用コンピュータ、ノート型パソコン、電子手帳、ページャ、電卓、ＰＯＳ端末、ＩＣカード、ミニディスクプレーヤなどの様々な電子機器を適用することができる。

【００２０】図２は、本発明による両面表示型の液晶表示装置を備えた電子機器としての携帯情報端末の他の実施の形態を示す斜視図であり、（ａ）は携帯情報端末を閉じた状態を示し、（ｂ）は携帯情報端末を開いた状態を示している。

【００２１】図２に示すように、本実施形態の携帯情報端末１１０では、蓋部１１４の外面および内面に形成された窓部１１４ａ、１１４ｂがいずれも蓋部１１４の外面および内面の大部分を占有するような比較的大きい略矩形の窓部である点で、上述した実施形態の携帯情報端

末１０と異なっている。この実施形態では、蓋部１１４の外面の窓部１１４ａによって露出した液晶表示装置１８の外側の面のうち、図２（ａ）で斜線で示す部分のみを外側表示面として使用できるように構成されている。この場合、液晶表示装置１８の外側表示面が、この斜線で示す部分のみになるように構成してもよいし、選択的に斜線で示す部分または窓部１１４ａによって露出されたすべての部分になるように構成してもよい。他の構成は上述した図１の実施形態と同様であるので、図２において図１の参照符号の百の位に１を付して、その説明を省略する。

【００２２】次に、上述した図１および図２に示す携帯情報端末１０、１１０に適用可能な本発明による両面表示型の液晶表示装置の実施の形態について説明する。図３は、本実施形態の液晶表示装置を示す断面図である。図３に示すように、液晶表示装置１８は、図示しないセルギャップ制御用のスペーサを介して一対の基板２４、３２が互いに対向するように配置された液晶パネル２２を備えている。これらの基板２４、３２には、それぞれ他方の基板に対向する面に走査線および信号線としての互いに離間して平行に延びる複数の透明電極２６、３０が形成されている。これらの透明電極２６、３０は、互いに交差するように配置されて単純マトリックス（パッシブマトリックス）型の液晶パネル２２を形成している。一対の基板２４、３２の対向する面の周縁部にはシール材３４が塗布されており、このシール材３４によって基板２４、３２間に充填されるＴＮ液晶層２８を封止している。なお、ＴＮ液晶層２８の厚さは、液晶パネルに電界を印加しない状態でＴＮ液晶層２８に入射した直線偏光がＴＮ液晶層２８を通過したときにその位相が９０°ずれるように設定されている。また、説明を容易にするために、図３および後述する同様な他の図面では、横方向の寸法に比べて縦方向（高さ方向）の寸法を拡大して示しており、一対の基板２４、３２の間の間隙は数μｍ乃至数十μｍである。

【００２３】液晶パネル２２の一方の側には第１の反射偏光板３６が配置され、他方の側には第２の反射偏光板３８が配置されている。また、第１の反射偏光板３６の外面側すなわち液晶パネル２２から遠い側には第１の吸収型偏光板４０が配置され、第２の反射偏光板３８の外面側すなわち液晶パネル２２から遠い側には第２の吸収型偏光板４２が配置されている。

【００２４】第１および第２の反射偏光板３６、３８は、例えば、国際公開（ＷＯ９５／１７６９２）において開示された多層構造フィルムからなる反射偏光子により構成することができる。図４に示すように、この多層構造フィルムは、重合体を延伸形成した異なる２種類の層、例えば、ポリエチレンナフタレートからなるＡ層と、ナフタレン・ジカルボン酸とテレフタル酸との共重合エステルからなるＢ層とを交互にＺ軸方向に積層した多層構造を有している。ＡおよびＢ層の各層は１μｍ以下の厚さであり、多層構造フィルム全体の厚さは２００μｍ程度である。

【００２５】多層構造フィルムからなる反射偏光子のＡ層のＸ軸方向の屈折率（n_{AX}）とＹ軸方向の屈折率（n_{AY}）は互いに異なるように設定され、Ｂ層のＸ軸方向の屈折率（n_{BX}）とＹ軸方向の屈折率（n_{BY}）は互いに略等しくなるように設定されている。また、Ａ層のＹ軸方向の屈折率（n_{AY}）とＢ層のＹ軸方向の屈折率（n_{BY}）は互いに略等しくなるように設定されている。したがって、これらの屈折率の間には、$(n_{AX}) \neq (n_{AY})$、$(n_{BX}) \fallingdotseq (n_{BY}) \fallingdotseq (n_{AY})$の関係がある。このように形成された第１および第２の反射偏光板３６、３８に入射した光のうちＹ軸方向の偏光軸を有する直線偏光は、実質的に各層間に屈折率の差がないので、そのまま透過する。

【００２６】また、隣接する一対のＡ層およびＢ層のＺ軸方向の膜厚をそれぞれt_A、t_Bとし、入射光の波長をλとして、以下の式（１）の関係を満たすように設定すれば、第１および第２の反射偏光板３６、３８に入射した波長λの光のうちＸ軸方向の偏光軸を有する直線偏光は、隣接するＡ層とＢ層の界面においてＸ軸方向の偏光軸を有する直線偏光として反射される。

【００２７】

$$t_A \cdot n_{AX} + t_B \cdot n_{BX} \fallingdotseq \lambda / 2 \qquad (1)$$

さらに、隣接するそれぞれの対のＡ層およびＢ層の膜厚t_A、t_Bを変化させ、可視光領域の広範囲の波長λにわたって上記の式（１）の関係を満たすようにそれぞれの対のＡ層およびＢ層の膜厚t_A、t_Bを設定すれば、第１および第２の反射偏光板３６、３８に入射した白色光のうちＸ軸方向の偏光軸を有する直線偏光をその方向の直線偏光として反射させることができる。

【００２８】したがって、第１および第２の反射偏光板３６、３８は、全可視光領域において、Ｘ軸方向の偏光軸を有する直線偏光をその方向の直線偏光として反射させ、Ｙ軸方向の偏光軸を有する直線偏光をその方向の直線偏光として透過させる。

【００２９】また、第１および第２の吸収型偏光板４０、４２は、透過軸方向に平行な偏光を透過し、透過軸方向と直交する吸収軸方向の偏光を吸収する偏光板であり、例えば、ヨウ素や染料などの二色性物質を用いることによって形成される。また、第１の吸収型偏光板４０はその透過軸が第１の反射偏光板３６の透過軸と略平行になるように配置され、第２の吸収型偏光板４２はその透過軸が第２の反射偏光板３８の透過軸と略平行になるように配置されている。そのため、第１および第２の吸収型偏光板４０、４２は、それぞれ第１および第２の反射偏光板３６、３８を透過するような偏光をそのまま透過させ、第１および第２の反射偏光板３６、３８によって反射されるような偏光を吸収する。したがって、第１

または第２の反射偏光板３６、３８の透過軸と直交する方向の偏光は、第１または第２の反射偏光板３６、３８に入射する前に第１または第２の吸収型偏光板４０、４２によって吸収され、その偏光が第１または第２の反射偏光板３６、３８に直接入射して反射光となるのを防止することができる。このように不必要な反射を防止することによって、表示コントラストを改善し、見やすい表示を実現することができる。

【００３０】さらに、本実施形態では、第１の反射偏光板３６および第１の吸収型偏光板４０は、それらの透過軸が第２の反射偏光板３８および第２の吸収型偏光板４２の透過軸と略平行になるように配置されている。

【００３１】次に、図５を参照して、上記のように構成された液晶表示装置１８を明るい光の下で反射型液晶表示装置として用いる場合の動作を説明する。なお、図５（ａ）は、液晶パネル２２に電界を印加しない場合、すなわち液晶パネル２２を通過する直線偏光の偏光軸を９０°回転（旋光）させる場合を示し、図５（ｂ）は、液晶パネル２２に電界を印加する場合、すなわち液晶パネル２２通過する直線偏光の偏光軸を回転させない場合を示している。また、図５において、アスタリスクは白色光などの偏光軸を有しない外光を示し、左右方向の矢印は紙面と平行な偏光軸を有する直線偏光を示し、丸の中に小さい黒丸を描いた記号は紙面に垂直な偏光軸を有する直線偏光を示している。

【００３２】まず、図５（ａ）の左側に示す場合、すなわち液晶パネル２２を通過する直線偏光の偏光軸を９０°回転させる状態の領域に外光６０が第１の吸収型偏光板４０の側から入射する場合について説明する。この場合、入射した外光６０は、第１の吸収型偏光板４０の吸収軸４０Ａの方向の偏光成分が第１の吸収型偏光板４０によって吸収され、第１の吸収型偏光板４０の透過軸４０Ｔの方向の偏光成分のみが第１の吸収型偏光板４０を透過し、その透過軸４０Ｔの方向の偏光軸を有する直線偏光６０ａとして出射する。この直線偏光６０ａは、第１の吸収型偏光板４０の透過軸４０Ｔと略平行な透過軸３６Ｔを有する第１の反射偏光板３６をそのまま透過して、さらに液晶パネル２２を通過する。液晶パネル２２を通過した直線偏光の偏光軸は９０°回転して直線偏光６０ｂとなり、第２の反射偏光板３８に入射する。第２の反射偏光板３８に入射した直線偏光６０ｂは、その偏光軸が第２の反射偏光板３８の反射軸３８Ｒと略平行であるため、第２の反射偏光板３８によって反射される。反射された直線偏光６０ｃは、第２の反射偏光板３８の反射軸３８Ｒに略平行な偏光軸を有し、液晶パネル２２に入射する。液晶パネル２２に入射した直線偏光６０ｃは、液晶パネル２２によってその偏光軸が９０°回転して、第１の反射偏光板３６の透過軸３６Ｔと平行な偏光軸を有する直線偏光６０ｄとなり、第１の反射偏光板３６をそのまま透過し、さらに第１の反射偏光板３６の透過軸３６Ｔと略平行な透過軸４０Ｔを有する第１の吸収型偏光板４０を透過して、第１の吸収偏光板４０の側の表示面に到達する。

【００３３】また、図５（ａ）の右側に示す場合、すなわち液晶パネル２２を通過する直線偏光の偏光軸が９０°回転する領域に外光６１が第２の吸収型偏光板４２の側から入射する場合も、上記の場合と同様に、第２の吸収型偏光板４２に入射した外光６１は、第２の吸収型偏光板４２の透過軸４２Ｔと平行な直線偏光６１ｄとして第２の吸収型偏光板４２の側の表示面に到達する。

【００３４】このように、液晶パネル２２を通過する直線偏光の偏光軸を９０°回転させる状態の領域に入射した外光は、その殆どが第１または第２の反射偏光板３６、３８で反射されて入射光と逆の経路で出射するため、第１または第２の吸収型偏光板４０、４２のいずれの側から外光が入射した場合でも、液晶パネル２２を通過する直線偏光の偏光軸を９０°回転させる状態の領域は明るい白色表示となる。

【００３５】次に、図５（ｂ）の左側に示す場合、すなわち液晶パネル２２を通過する直線偏光の偏光軸を回転させない状態の領域に外光６２が第１の吸収型偏光板４０の側から入射する場合について説明する。この場合、入射した外光６２は、第１の吸収型偏光板４０の吸収軸４０Ａの方向の偏光成分が第１の吸収型偏光板４０によって吸収され、第１の吸収型偏光板４０の透過軸４０Ｔの方向の偏光成分が第１の吸収型偏光板４０を透過して、その透過軸４０Ｔの方向の偏光軸を有する直線偏光６２ａとして第１の吸収型偏光板４０から出射する。この直線偏光６０ａは、第１の吸収型偏光板４０の透過軸４０Ｔと略平行な透過軸３６Ｔを有する第１の反射偏光板３６をそのまま透過し、偏光軸を回転することなく液晶パネル２２を通過し、第１の吸収型偏光板４０の透過軸４０Ｔと略平行な透過軸３８Ｔを有する第２の反射偏光板３８を透過し、第２の反射偏光板３８の透過軸３８Ｔと略平行な透過軸４２Ｔを有する第２の吸収型偏光板４２を透過してそのまま進行し、第１の吸収型偏光板４０の側の表示面には戻らない。

【００３６】また、図５（ｂ）の右側に示す場合、すなわち液晶パネル２２を通過する直線偏光の偏光軸を回転させない状態の領域に外光６３が第２の吸収型偏光板４２の側から入射する場合も、上記の場合と同様に、第２の吸収型偏光板４２に入射した外光６３は、第１の吸収型偏光板４０の透過軸４０Ｔと平行な偏光６３ａとして第１の吸収型偏光板４０を透過してそのまま出射され、表示面である入射側には戻らない。

【００３７】このように、液晶パネル２２を通過する直線偏光の偏光軸を回転させない状態の領域に入射した外光は、入射側とは逆側に透過して入射側には戻らないため、第１または第２の吸収型偏光板４０、４２のいずれの側から外光が入射した場合でも、液晶パネル2･2を通

過する直線偏光の偏光軸を回転させない状態の領域は暗い表示となる。

【0038】上述したように、本実施形態の液晶表示装置18は、明るい外光の下で反射型液晶表示装置として使用する場合、液晶パネル22を通過する直線偏光の偏光軸を90°回転させる状態の領域は、液晶パネル22のいずれの側を表示面として用いた場合でも明るい白色表示領域となり、液晶パネル22を通過する直線偏光の偏光軸を回転させない状態の領域は、液晶パネルのいずれの側を表示面として用いた場合でも暗い表示領域となって、両面表示を行うことができる。なお、液晶パネル22は、通過する直線偏光の偏光軸を90°回転させる状態と回転させない状態との中間の状態にして中間調表示を行うことができる。

【0039】上述したように、本実施形態の液晶表示装置18は、1枚の液晶パネル22を使用して両面に画像を表示可能な反射型液晶表示装置として使用することができ、2枚の液晶パネルを使用して両面に画像を表示する液晶表示装置と比べて、部品点数および重量を削減し、厚さを薄くすることができる。また、液晶表示装置18では、液晶パネル22の両面の全面にわたって配置される反射偏光板36、38が反射板として作用する反射型液晶表示装置として使用することができるため、液晶パネル22の全面にわたって両面に画像を表示することができる。さらに、第1および第2の反射偏光板36、38は所定の方向の偏光軸を有する偏光を殆ど反射することができるため、明るい反射型液晶表示装置となる。

【0040】上記の実施例は、単純マトリクス型のTN液晶パネルを持つ液晶表示装置であるが、TN液晶パネルを持つ2端子や3端子のアクティブマトリクス型の液晶表示装置であっても、同様の効果が得られる。

【0041】図6は、図1および図2に示す携帯情報端末10、110に適用可能な本発明による両面表示型の液晶表示装置の他の実施の形態を示す断面図である。図6に示すように、本実施形態の液晶表示装置118では、図3に示す実施形態の液晶表示装置18の構成に加えて、光を散乱させ拡散させる機能を有する散乱層44が液晶パネル22と第2の反射偏光板38と間に配置されている。この散乱層44は、第2の反射偏光板38で反射された部分に対応する表示画像が鏡面により反射された光であるような表示画像となるのを防止し、第2の反射偏光板38で反射された部分に対応する表示画像をペーパーホワイトに近い表示画像にするために使用される。散乱層44は、例えば、ビーズを分散させたプラスチックフィルムからなり、液晶パネル22と第2の反射偏光板38を接着する光学接着剤からなる接着層中にビーズを混入させることによって形成することができる。なお、散乱層44は、液晶パネル22と第2の反射偏光板38との間に限らず、液晶パネル22と第1の反射偏光板36との間、第1の反射偏光板36と第1の吸収型偏光板40との間、第2の反射偏光板38と第2の吸収型偏光板42との間、第1の吸収型偏光板40または第2の吸収型偏光板42の外面側のいずれに配置してもよい。また、散乱層44を透過した直線偏光の偏光軸は変わらないので、図5に示したような液晶パネル22に入射する光の挙動には影響を与えない。他の構成は図3に示す実施形態と同様であるので、図6において図3の実施形態の液晶表示装置18に対応する部分に同一の符号を付して、その説明を省略する。

【0042】図7は、図1および図2に示す携帯情報端末10、110に適用可能な本発明による両面表示型の液晶表示装置のさらに他の実施の形態を示す断面図である。図7に示すように、本実施形態の液晶表示装置218では、図3および図6に示す実施形態の液晶表示装置18および118のTN液晶層28封止した液晶パネル22の代わりに、STN液晶層128を封止した液晶パネル122を使用するとともに、このSTN型の液晶パネル122によって発生する着色を解消するために、第1の反射偏光板36と第1の吸収型偏光板40との間および第2の反射偏光板38と第2の吸収型偏光板42との間に位相差板46、46を設けている。また、第1の反射偏光板36および第1の吸収型偏光板40の透過軸と第2の反射偏光板38および第2の吸収型偏光板42の透過軸との間の角度は、STN型の液晶パネル122のツイスト角に応じて決定されている点で、TN型の液晶パネル22を使用する図3の実施形態の場合と異なる。さらに、本実施形態の液晶表示装置218の動作は、STN型の液晶パネル122による位相のずれを位相差板46、46によって補償する点を除いて、上述した図3の実施形態と同様である。他の構成は図6に示す実施形態と同様であるので、図7において図6の実施形態の液晶表示装置118に対応する部分に同一の符号を付して、その説明を省略する。なお、位相差板46、46は、STN型の液晶パネル122による着色が問題にならなければ、必ずしも設ける必要はなく、あるいは位相差板46、46の一方のみを設けるようにしてもよい。

【0043】また、図3、図6または図7に示す実施形態の液晶表示装置18、118、218において、最も外面側の一方に図示しない光吸収層を着脱可能に配置してもよい。この光吸収層は、この光吸収層がない側を表示面として使用したときに反射板として機能する第1または第2の反射偏光板36、38を透過した光を吸収するとともに、光吸収層が配置する側の第1または第2の吸収型偏光板40、42に入射する外光を吸収するので、コントラストを改善することができる。

【0044】上述したように、図3、図6および図7に示す両面表示型の液晶表示装置18（118、218）は、液晶パネル22（122）の両面の全面にわたって

画像を表示する構成であり、このような液晶表示装置１８（１１８、２１８）を図１および図２に示す実施形態の携帯情報端末１０（１１０）に適用する場合には、蓋部１４（１１４）を閉じているときに液晶表示装置１８（１１８、２１８）の外側表示面の全面にわたって画像を表示する必要はない。また、蓋部１４（１１４）を閉じているときにも液晶表示装置１８（１１８、２１８）の外側表示面の全面にわたって画像を表示すると消費電力が大きくなる。そこで、本発明では、液晶表示装置１８（１１８、２１８）の外側表示面の一部の領域だけを表示状態とし、他の領域を非表示状態にして消費電力を低減している。また、外面表示時と内面表示時で画像の反転は、フォントローテーションや走査方向を切り替えることによって防ぐことができる。

【００４５】以下、このように液晶表示装置１８（１１８、２１８）の外側表示面の一部の領域だけを表示状態とすることができる本発明による液晶表示装置の駆動回路の実施の形態について説明する。

【００４６】図8は、本発明による液晶表示装置１８（１１８、２１８）の駆動回路の実施の形態を示すブロック図である。

【００４７】図8に示すように、本実施形態の液晶表示装置１８（１１８、２１８）の駆動回路２１０は、画像表示を制御する表示制御２１１と、この表示制御回路２１１によって制御されるシフトレジスタにより複数の走査線２６に走査電位を順次供給し線順次走査を行う走査線ドライバ２１２と、この走査ドライバ２１２により選択された各画素に対し、表示制御回路２１１によって制御されるシフトレジスタにより複数の信号線３０に各画素の画像データに対応する信号電位を供給する信号線ドライバ２１３とを備えている。

【００４８】走査線ドライバ２１２により走査線２６に供給される走査電位、および信号線ドライバ２１３により信号線３０に供給される信号電位は、液晶電位生成回路２００によって生成され、それぞれ走査線ドライバ２１２、信号線ドライバ２１３に供給される。

【００４９】また、駆動回路２１０は、図９（ａ）に示す液晶表示装置１８（１１８、２１８）の左側の斜線部分のみを表示領域として他の領域を非表示領域とする場合や図９（ｂ）に示す液晶表示装置１８（１１８、２１８）の上側の斜線部分のみを表示領域として他の領域を非表示領域とする場合のように、液晶表示装置１８（１１８、２１８）の一部のみを表示領域として他の領域を非表示領域とすることができるように構成されている。すなわち、駆動回路２１０は、例えば、特開平６－９５６２１号に開示されている方法と同様に、図９（ａ）に斜線で示す領域のみを表示領域とする場合には、液晶表示装置１８（１１８、２１８）の表示面信号線ドライバ２１３のシフトレジスタの表示領域に対応する部分に画像データに応じたデータを転送し、非表示領域に対応する部分にオフデータを転送する。このようにしてでデータの転送のための消費電力を低減するように構成されている。

【００５０】また、図９（ｂ）に斜線で示す領域のみを表示領域とする場合には、上側の表示領域に対応する走査線２６のみを選択して他の走査線２６を選択しないようにして消費電力を低減するように構成されている。

【００５１】あるいは、特開平７－２８１６３２に開示された周知の方法または本発明者らの特願平９－５１８７５１に開示された方法を使用して、液晶表示装置１８（１１８、２１８）の外側表示面の一部の領域だけを表示状態とし、他の領域を非表示状態にすることにより、液晶表示装置１８（１１８、２１８）の消費電力を低減するようにしてもよい。

【００５２】上述したように、本発明による両面表示型の液晶表示装置では、液晶表示装置の表示面の一部のみを表示領域とし、他の部分を非表示領域としたので、液晶表示装置の消費電力を低減することができる。

【図面の簡単な説明】

【図１】本発明による両面表示型の液晶表示装置を備えた電子機器としての携帯情報端末の実施の形態を示す斜視図。

【図２】本発明による両面表示型の液晶表示装置を備えた電子機器としての携帯情報端末の他の実施の形態を示す概略図。

【図３】本発明による両面表示型の液晶表示装置の実施の形態を示す断面図。

【図４】図３に示す実施の形態の両面表示型の液晶表示装置の反射偏光板として使用される多層構造フィルムからなる反射偏光子を概略的に示す斜視図。

【図５】図３に示す両面表示型の液晶表示装置の動作の説明図。

【図６】本発明による両面表示型の液晶表示装置の他の実施の形態を示す断面図。

【図７】本発明による両面表示型の液晶表示装置のさらに他の実施の形態を示す断面図。

【図８】本発明による両面表示型の液晶表示装置の駆動回路の実施の形態を示すブロック図。

【図９】本発明による両面表示型の液晶表示装置の外側表示面の表示領域と非表示領域を示す概略図である。

【符号の説明】

１０、１１０　携帯情報端末
１２、１１２　本体部
１４、１１４　蓋部
１６、１１６　入力部
１８（１１８、２１８）　液晶表示装置
２０、１２０　ピン
２２、１２２　液晶パネル
２４、３２　基板
２６　透明電極（走査線）

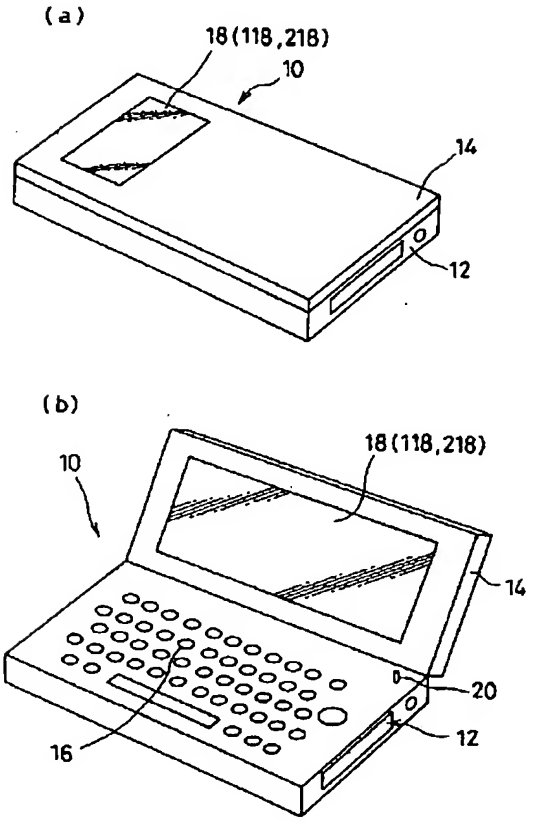
１５

２８　ＴＮ液晶層
３０　透明電極（信号線）
３４　シール材
３６　第１の反射偏光板
３８　第２の反射偏光板
４０　第１の吸収型偏光板
４２　第２の吸収型偏光板
４４　散乱層

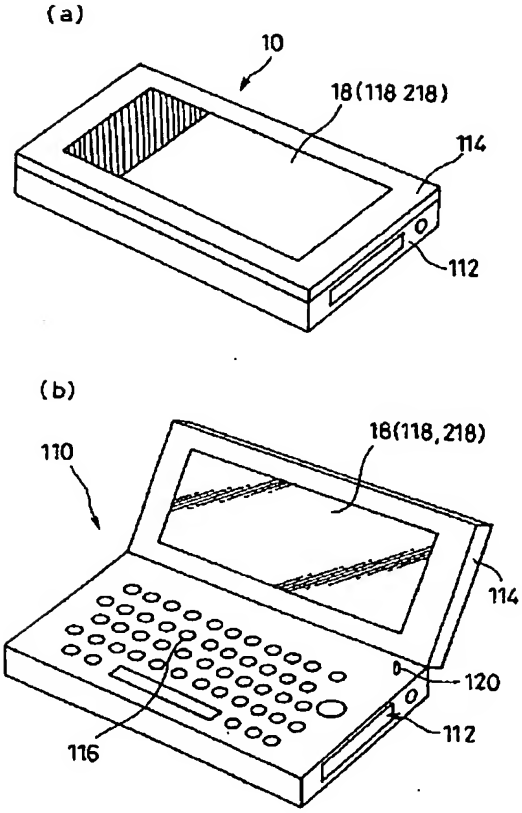
１６

４６　位相差板
１２８　ＳＴＮ液晶層
２００　液晶電位生成回路
２１０　駆動回路
２１１　表示制御回路
２１２　走査線ドライバ
２１３　信号線ドライバ
２２０　使用状態検出手段

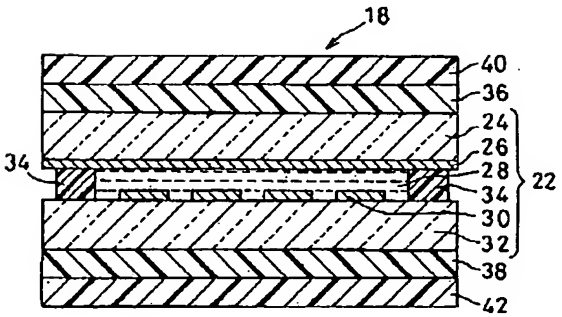
【図１】



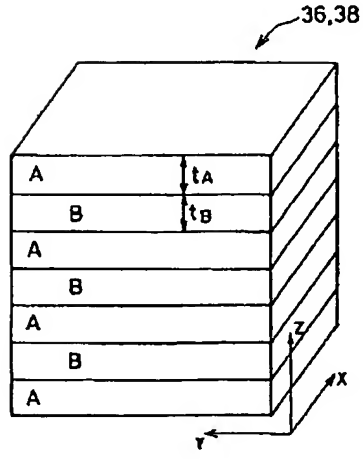
【図２】



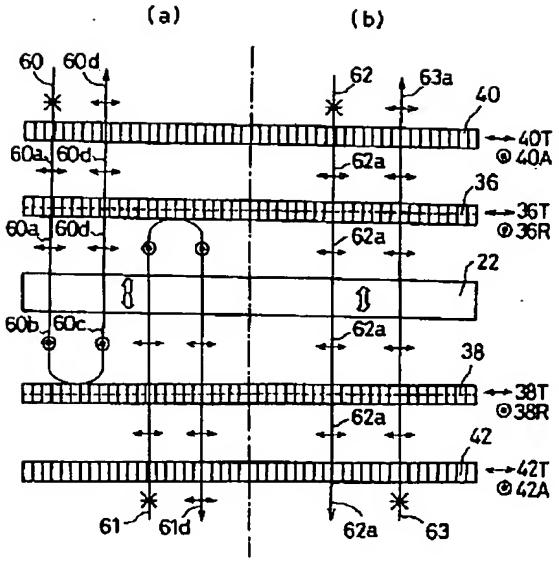
【図３】



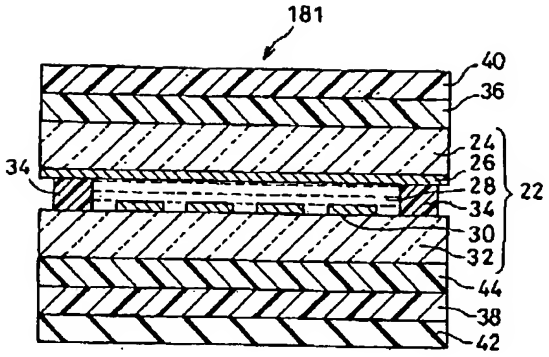
【図４】



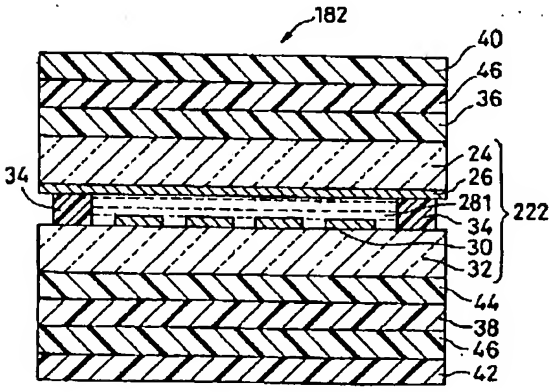
【図5】


(a)
(b)
60
60d
62
63a
40
40T
40A
60a
60d
62a
36
36T
36R
60a
60d
62a
22
60b
60c
62a
38
38T
38R
62a
42
42T
42A
61
61d
62a
63

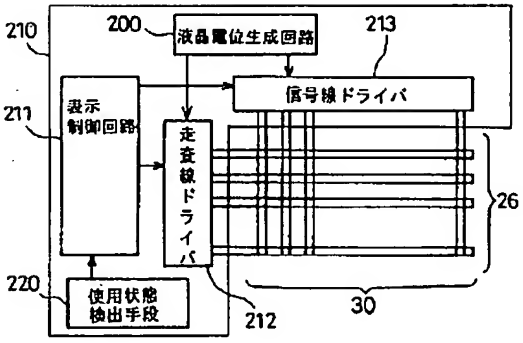
【図6】


181
40
36
24
26
28
34
30
32
22
34
44
38
42

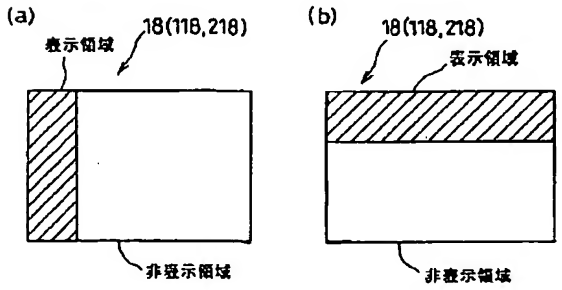
【図7】


182
40
46
36
24
26
281
34
30
32
222
34
44
38
46
42

【図8】


210
200
液晶電位生成回路
213
信号線ドライバ
211
表示制御回路
走査線ドライバ
26
220
使用状態検出手段
212
30

【図9】


(a)
表示領域
18(118,218)
非表示領域
(b)
18(118,218)
表示領域
非表示領域

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ABSTRACT:

PROBLEM TO BE SOLVED: To attain image display over an entire area on one side of a liquid crystal panel, while in a part on the other side.

SOLUTION: A double display type liquid crystal display device 18 has a liquid crystal panel 22, with a liquid crystal layer 28 held between a pair of substrates 24, 32, a pair of reflective polarizing plates 36, 38 which are disposed on both sides of the liquid crystal panel, reflect polarized light having axis of polarization in a 1st direction, transmit the polarized light

having the axis of polarization in a 2nd direction which is different from the 1st direction and form 1st and 2nd display faces, capable of displaying images on both sides of the liquid crystal panel, a service condition detecting means 220 which detects a 1st usage condition for displaying the image on the 1st display face and a 2nd usage condition for displaying the image on the 2nd display face and a drive circuit 210, which makes a region of the 1st display face the display region and makes the other region the non-display region, when the 1st usage condition is detected and makes the whole area of the 2nd display face into a display region, when the 2nd service condition is detected.